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METEOROLOGICAL COUNCIL,

1879—1880.

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MINUTES OF THE PROCEEDINGS

OF THE

METEOROLOGICAL COUNCIL.

1879—80.

116, *Victoria Street, May* 8, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	THE HYDROGRAPHER.
MR. GALTON.	PROFESSOR STOKES.

LIEUT.-GENERAL STRACHEY.

The Secretary was in attendance.

The Minutes of last meeting (March 28) were read and confirmed.

The Chairman and Secretary reported that in accordance with the instructions of the Council they had attended the Meteorological Congress which was held at Rome from the 14th to the 22nd ultimo. They submitted the Report (in proof) of the proceedings of the Congress.

The Chairman stated that the Congress had appointed an International Meteorological Committee to discharge the same functions which had been confided by the Vienna Congress to its Permanent Committee. The International Committee had appointed Prof. Wild its President, and Mr. Scott its Secretary; and the Chairman had intimated to the Committee that the Council would be ready to publish an English edition of the Report of the Congress, and would also be willing to allow Mr. Scott, in his capacity as Secretary of the International Committee, the same assistance from the staff of the Office which he had received during the last five years as Secretary of the Permanent Committee.

Read—The following letter from Captain Abney (Minutes, p. 145):

M.O. 919.

SIR, 3, St. Alban's Road, Kensington, April 12, 1879.

THE Meteorological Council having requested me to give my opinion regarding the method to be adopted for registering the height, velocity, and direction of the motion of Clouds by means of photography, I have the honor to submit the following suggestions for their consideration.

Ascertaining the Height of Clouds.

1*st. The Apparatus to be employed.*—From experiments I have made expressly, and which confirm my past experience in the matter, I am of opinion that, in the majority of cases, clouds which lie somewhat in the direction of the sun will be more easily photographed and identified than those which are further removed from it. Such being the case, the apparatus required would consist of cameras mounted on an altazimuth mounting, with divided circles to read to (say) 5′ of arc, together with a means of adjusting the cameras, so that they shall occupy a fixed position in regard to one another. The lenses to be employed should be ordinary photographic doublets known as the "rectilinear," but whether of the "rapid" or wide angle form has yet to be determined. There is no distortion in either form.

In compliance with the Council's wishes, I am having a model of the camera and its mounting made.

2nd. As to the Process to be employed.—I am of opinion that a dry-plate process possesses many a vantages over the wet-plate process for this work, and the most simple of the dry-plate processes is that known as the "collodio-bromide emulsion process." This process I therefore recommend for adoption, having found it thoroughly capable of doing this particular class of photography.

3rd. The Mode of Exposure.—I believe that no mode of exposure will be satisfactory unless it be one by which the lenses can be uncovered simultaneously and for equal times, when cameras are placed in position at the ends of a base line. The exposure will ordinarily be the fraction of a second, and it will be evident that no exposure that can be given by hand will be sufficiently exact. I therefore submit that an electric arrangement be worked out for this purpose. It must be one in which the exposure given can be varied as necessity arises. It must be one which can be worked automatically from one station, and it also must be one which is not dependent on the action of gravity for moving the shutter, since in some cases the lenses may point to the zenith. There are certain practical difficulties in designing such an apparatus so as to give it a light and simple form, but I am in hopes that they may be overcome.

4th. Measurements of the Photographs.—The measurements of clouds should be made from the negative pictures, since certain faint forms of clouds would be hard to distinguish from the sky in positive pictures.

5th. Length of Base Line.—The distance apart of the cameras must depend on the probable height of the clouds to be photographed, and on this point I can say nothing.

Registration of the Velocity and Direction of Clouds.

As to the registration of the velocity, and direction of motion, of a cloud I cannot offer a definite opinion; but as far as my experiments have gone, I believe that it will be necessary to take a second negative from the station after the negatives for ascertaining its height have been exposed. This second plate should be exposed twice, a recorded time elapsing between the two exposures. This would enable the velocity of the cloud to be calculated, and would at the same time show the direction of motion.

I shall be happy to furnish the Council with any other information in my power, and to make any experiments they may suggest, provided they do not interfere with my official duties.

I have, &c.

The Secretary,
Meteorological Council.

W. de W. Abney,
Capt. R.E.

Read—A Letter (No. 795) from Mr. Ley, on the subject of "Cirrus"-cloud observations (p. 144). The Secretary was instructed to ask Mr. Ley to send in his scheme for such observations.

Read—A Letter (No. 1062) from Mr. Whipple, stating that the cost of a wooden erection, as designed by Prof. Wild, to contain his thermometer screen, would be about 25*l*. The Secretary was instructed to request Mr. Whipple to obtain an estimate for a rough temporary arrangement.

The Secretary reported that he had received a communication (Letter 926) from the Post Office relating to the charges for International Weather Telegrams, and that the matter was still under discussion.

Read—The following Report:

Report on Daily Forecasts of Weather.

May 8, 1879.

On April 1st we commenced the regular issue of Daily Forecasts of Weather for the 11 districts in the British Islands (shown on the map in margin). The Forecasts are drawn up three times a day on each week-day (viz., at 11 a.m., 3.30 p.m., and 8 p.m.), and twice a day on Sunday (viz., 6.30 p.m. and 8 p.m.). Those drawn up on week-days are immediately issued to the public in the manner to be presently described, but with regard to those prepared on Sundays (or, rather, that prepared at 6.30 p.m. on Sunday,) we require some further instructions, as will be seen further on.

I beg leave to submit for consideration of the Council the following notes, &c.:—

1. *Inquiry by Wire, and personally, for Forecasts, &c.*—In the course of the period April 1st to May 7th, or about six weeks, we received the following inquiries:

By wire - - 51	Personally - - 11

Inquiries have been much more frequent in periods of changeable than in fine weather, and especially numerous just before a general holiday, such as Easter time.

Taking the total number of inquiries into consideration, it will be found that they have averaged about two a day; on one day we had as many as six (five by wire and one personally), but occasionally several days have passed without any at all.

At the close of this Report there is a list of queries which have presented themselves from time to time. These will be found on pp. 3 and 4, and on them I should be glad to receive definite instructions.

2. *Supply of Forecasts to Subscribers.*—During the month of April the 3.30 p.m. Forecasts for the London District were issued *gratis* to about 25 Clubs in the neighbourhood of Pall Mall, and also to 33 subscribers to the Daily Weather Report, whose residences lie within the London Postal District and whose Reports are posted to them direct from the Meteorological Office. The free supply to the Clubs ceased at the end of April, but that to the Weather Report subscribers, named above, is still in force.

11 *a.m. Forecasts.*—The demand for the 11 a.m. Forecasts has not been large at present, being confined to *one* private subscriber (for the London District) and two newspapers, "Globe" and "Times," for all the districts.

3.30 *p.m. Forecasts.*—The demand for these Forecasts has been much larger than for those issued at 11 a.m., and is increasing steadily. Sixteen of the Clubs have commenced to subscribe for the *London District* Forecasts at this hour, five other subscribers receive Forecasts daily (except on Sundays) for some *one* of the 11 districts, and 33 copies (for London District) are still sent *gratis* to the London subscribers for the Daily Weather Report referred to above.

In addition to these six copies of the Forecasts for *all* districts are issued daily for the *Press*, four to provincial newspapers, through Messrs. Shanks, Revell, & Co., one to the "*Scotsman*," and one to the "*Sheffield Daily Telegraph*," (through the Press Association).

There are several other newspapers (chiefly weekly papers) which take these Forecasts on certain days of the week only.

8 *p.m. Forecasts.*—With regard to the 8 p.m. Forecasts, the "*Times*" alone is at present supplied, but the "*Standard*" has also agreed to the terms proposed in order that they should participate with the "Times" in their publication. The proposals of the "Daily Telegraph" and "Daily Chronicle" have proved abortive.

Each set of Forecasts (viz., 11 a.m., 3.30 p.m., and 8 p.m.) is exhibited at the Office door, together with a chart of the actual weather for 8 a.m. or 6 p.m.:

	Are exhibited from	To
The 11 *a.m.* Forecast (with 8 a.m. Chart) - -	11.15 a.m.	3.40 p.m.
„ 3.30 p.m. „ (do.) - -	3.40 p.m.	7.30 „ (Or till dark in winter).
„ 8 p.m. „ (with 6 p.m. Chart) - -	8 a.m. next day	11.15 a.m.

3. In preparing these Forecasts for issue the small printing press, recently supplied, is used very largely. At present it is employed mainly in printing the Forecasts for the London District only; and it is found that (the heading being kept permanently in type) the Forecast can be set up, corrected, and 60 copies be printed in about half an hour. When once the matter is "set up" we can easily print from 900 to 1,000 copies per hour.

Should the issue of 4 p.m. Forecasts for *all* districts increase much it will become necessary to print them also. They would take rather longer to "set up" than those for the London District only, but no longer to print off. To expedite matters it would be advisable to have stereotypes prepared of the "form" in which the Forecasts are issued, together with the longer and more frequently used words, in type uniform with that now in use.

There is one serious contingency which should be provided for; should the present printing press fall out of repair it would be impossible to issue the Forecasts promptly, even at the present rate of demand.

4. The following questions, some of them of great importance, have presented themselves of late, and need attention:—

a. It is stated that the dates to which the Forecasts refer should *always* be added to the form in which they are issued.

b. There is considerable doubt as to the period to which the Forecasts issued at 11 a.m. refer. We cannot at present draw them, with any reasonable hope of success, for the whole of the succeeding day, and I would therefore submit that they should be made to refer to the 24 hours *beginning* at noon on the day of issue.

c. It is proposed that it should be suggested to the "Times" to print a small chart daily showing the limits of the districts to which the Forecasts refer.

d. Some applicants (*e.g.*, the "Scotsman" and other daily papers which publish our usual 3.30 p.m. Forecasts) have stated that the *Saturday* afternoon Forecasts are of no use to them, and have asked to be supplied with *Sunday* Forecasts in lieu of them. These might be prepared from the 8 a.m. reports and such 2 p.m. reports as we receive, and could be ready (say) by 7 p.m. on Sunday, when they could be issued to those who may arrange to send for them. If this be granted I would propose that a special charge be made for them, as the time now available on Sundays is so limited that should they become at all numerous, additional help would be required in order to get the copies ready.

e. Application has been made by wire, frequently, for information as to weather several days in advance, the first notice issued to the public by the Post Office having contained no statement as to the limit of time to which the Forecasts refer. This mistake has now been rectified. Hitherto the plan pursued in answering such applications has been to send the latest Forecasts issued, and to explain that Forecasts "are not given for more than one day in advance."

f. In the last circular issued it is stated that "*All Forecasts*," &c. when sent by post will be sent as *letters* not as cards, to ensure punctuality in delivery. Is this to be *rigidly* adhered to,

or, if especially desired by recipient, may they be sent by book post or be enclosed with the Weather Reports to those persons who already receive the Daily Weather Reports?

g. In the last circular all mention of the 8 p.m. Forecast is omitted. Are they not to be supplied under any circumstances? If otherwise, under what conditions may the supply be carried out?

Obviously the circular will need some revision when the above points are settled.

FREDC. GASTER.

Resolved—

I. That the time of issue be printed on each Forecast, with a statement that the 11 a.m. Forecast holds till Noon on the following day; and the afternoon Forecasts for the following day.

II. That Sunday Forecasts be supplied to newspapers requiring them, without extra charge at present.

The Secretary reported that more than one of the London Daily Papers had applied for copies of the Chart and Forecasts, as supplied at night to the "Times," for its first edition, and that he had communicated with the manager of the "Times" on the subject, and had received the following reply:—

M.O. 859.

The "Times," Printing House Square,
April 5, 1879.

DEAR SIR,

THERE will be no objection on our part to your supplying the "Daily News," the "Daily Telegraph," or any other morning paper either in London or the country with the 6 p.m. Forecasts, provided they divide equally with us the cost, which we now bear exclusively. The information in losing its exclusiveness will of course also lose much of its value for us; and I will not undertake to say that we may always think it worth our while (for example) to pay 250*l.* per annum with another journal for what to ourselves alone is now thought well worth double that amount. Of course the Meteorological Office looks at the question from a different point of view, and desires to circulate as widely as possible the weather facts which it takes the chief part in accumulating. It may, however, be worth your while to consider carefully the whole of this subject before committing yourselves finally to a system of Press supply, very easy for the newspapers in combination, but not as it seems to me altogether satisfactory for you. The data on which your 6 p.m. Chart is constructed are not as comprehensive as they should be, and it is doubtful whether the hour is late enough. It is certain also that a good deal more money ought to be spent on these evening observations to make the Forecasts founded on them as complete as is desirable. But if you omit the present opportunity it may never recur, for getting out of the newspapers a suitable accession of revenue toward the cost of your meteorological researches. All I bargain for in the matter on behalf of the "Times" is, that we shall not be subjected to any handicapping process in respect of money payments, which should be quite equal all round. You will doubtless have it proposed to you to take only the 6 p.m. Forecasts with a proportionate reduction for not using the Chart. I think we would have just cause of complaint if you consented to any such scheme.

Believe me, &c.

The Secretary, Meteorological Office.

JOHN C. MACDONALD.

The Secretary further reported that the Editor of the "Standard" had been one of the applicants, and had consented to share with the "Times" the cost of the information. At an interview between the Secretary and Mr. MacDonald, which took place on the 5th instant, it was proposed on the part of the "Times" that the contribution from each newspaper receiving any portion of the 6 p.m. information should be 300*l.* a year; the Office on its part undertaking that any profit arising out of the arrangement, over and above the present cost (500*l.* per annum), should be devoted to the improvement of the service.

Read—Letter 1052 from the "Standard," accepting the terms of 300*l.* a year, proposed by the "Times."

Resolved—That the supply of the evening information to the "Standard" be sanctioned.

Mr. Scott was instructed to suggest additional stations, from which reports for 6 p.m. are to be received; and also to submit a memorandum on the feasibility and cost of forecasts founded on observations taken at 10 p.m.

Read—The following letter:—

M.O. 921.

The Patent Type Founding Company,
31, Red Lion Square, April 16, 1879.

DEAR SIR,

WE beg to make application to be supplied with copy of Forecasts you now prepare from 2 p.m. information. Our purpose is not to make a commercial use of it, but to give the same gratuitously to the newspapers who continue to use the Weather Chart blocks, and attached to the afternoon "Remarks" with which you now furnish us on terms agreed.

In making this application we request your consideration that we have been most diligent in our part of the work, and up to the present time have had no adequate return beyond our outlay.

We are, &c.

SHANKS, REVELL, & Co.,
Proprietors.

The Secretary, Meteorological Office.

Mr. Scott was authorised to supply the 2 p.m. Forecasts to Mr. Shanks, for a nominal payment of 1*l.* annually, for a single daily Forecast, and 1*s.* per annum for each newspaper to which a copy is supplied by him; on the understanding that Mr. Shanks is only to supply the Forecasts to newspapers to which he supplies the blocks.

Submitted—An application (Letter 1022) from the National Press Agency for Forecasts at a reduced rate. Mr. Scott was authorised to supply Forecasts to Press agencies at a discount of 25 per cent.

Mr. Scott was instructed to supply the Forecasts to the Admiralty.

Resolved—That Mr. W. H. Preece be invited to have an interview with the Council, with reference to the distribution of the Forecasts in the London District.

Read—Letter 790 from Dr. Neumayer, Director of the Deutsche Seewarte, Hamburg, requesting the Meteorological Office to supply Monthly Summaries of the Weather in the United Kingdom, to be employed in the preparation of the Monatliche Uebersichten der Witterung, issued in Hamburg.

The Secretary was instructed to remind Dr. Neumayer that he receives the Weekly Summaries of Weather published by this Office, which the Council believe will fully answer his purpose, and of which he is authorised to make any use he pleases.

Read—A Letter (No. 983) from the Hydrographer, submitting a new edition of the Admiralty "Wind and Current" Charts.

Mr. Galton submitted to the Council a proof of the wind-rose plate as ordered, Minutes, March 21, and explained the principle of its construction. He was requested to have a similar plate, with certain improvements, prepared for the month of April.

Mr. Galton was authorised to have certain additions made to the wind-rose machine; and to enlarge the scale of the Chart on which the wind-roses are planned.

It was agreed to chart the Current observations on a separate plate.

Submitted the following statements :—

STATEMENT of WORK done in MARINE ROOM during MARCH 1879.

April 1879.

New Logs examined, 11 in number.

Sea Temperatures in Squares 440 and 441 for all months, grouped under each degree Fahrenheit for each single-degree Square.

Wind-Area Instrument.—The manipulation, &c. has occupied considerable time.

Cape Gale Tables for January nearly completed.

Collection of Data for Cape of Good Hope.—The "preparation" of Dutch extracts commenced and fairly advanced (130 sheets prepared out of 436 to be done). The "extraction" commenced, but making very slow progress; only 42 sheets extracted. The training of additional hands on this work has caused considerable interruption to Marine staff.

Pacific Charts of Sea Temperature and Current.—10 in number, prepared for plotting, and plotting fairly commenced.

M. Mascart's Work completed as far as extraction of data is concerned.

Collection of Meteorological Data in Indian Ocean.—Considerable progress made by *outside assistance* in copying data.

Journal and Work-Books of Room give full details if required.

R. H. Scott, Esq.

CHARLES HARDING.

STATEMENT of WORK done in MARINE ROOM during APRIL 1879.

May 5, 1879.

New Logs examined.—11 in number.

Sea Temperatures in Square 442 for all months, grouped under each degree Fahrenheit for each single-degree Square. (This completes the grouping of Sea Temperatures for the three Northern Cape Squares.)

Currents for three Northern Cape Squares grouped into single-degree Squares. No summing or meaning done at present.

Winds for three Southern Cape Squares grouping commenced.

Wind-Area Instrument.—Copper plate engraved with January Wind data for three Northern Cape Squares. The adjustment and manipulation of instrument has occupied considerable time.

Cape Gale Tables.—The tabulation for January completed and July commenced. Only 13 hours of one person's time devoted to this in month.

Collection of Data for Cape of Good Hope.—The "preparation" of Dutch extracts well advanced (231 sheets prepared in month, leaving 75 to be done). The "extraction" has improved in progress (170 sheets extracted in month, leaving 224 yet to be done). The training of additional hands (three in number) for the Dutch "extraction" has taken much time of the Marine staff.

Pacific Charts of Sea Temperature and Current.—The February Chart about three-quarters completed.

M. Mascart's Work.—The extraction examined, &c. and forwarded.

Collection of Meteorological Data in Indian Ocean.—The copying almost completed by *outside assistance.*

R. H. Scott, Esq. CHARLES HARDING.

M.O. 783.

WORK done in the PANTAGRAPH ROOM during MARCH 1879.

March 29, 1879.

The following statement of work done in this branch of the Office is for the four weeks since February 28th, the date of my last Report:

Copper Plates.—Six plates, Nos. 28–30 (1876) and 1–3 (1879), have been completely pantagraphed, and Nos. 25–27 have had the rain traces added to them. All these plates, with the exception of Plate 3, will be completed by the engraver by the 31st instant.

Zinc Plates.—Barograph curves have been cut for Plates 1–4 (1879); Thermograph curves, Plates 2–6; Anemograms, Plates 29 and 30 (1876) and 1–3 (1879); Rain Curves, Plates 25–30 and 1–3; Vapour Tension, Plates 1–3 (1879).

Photographic Curves.—The ruling of the fiducial lines has only kept pace with the cutting of the zinc plates. There are therefore no curves prepared for the Pantagraphs in advance of those already used.

Examination Work.—This has been checked as usual, and the "Remark sheets" written for the month of December 1878. The work was received by me on March 6th. At some observatories a very large number of errors had been made, and our work was considerably increased in consequence.

Although the proper time has passed by, I have not yet received the papers for January 1879. Mr. Allen reports that they are nearly ready, but have been delayed by his having had to work on the Valentia and Armagh returns required by the Registrar General for Ireland. On the other hand, Mr. Bourne has been assisting him for three weeks, and has done a good deal of the checking of subsidiary sheets, &c. &c.

Owing to the fact that the January curves have been in use for the examination work as well as for pantagraphing, and also that some of them were required for the latter purpose before they had been checked, the cutting of the 1879 curves has not been quite so straightforward as could be wished, and has necessitated a good deal of changing about of the curves, &c. from room to room. Mr. Cobley's illness has also left us short-handed and materially reduced our output for the month.

R. H. Scott, Esq., F.R.S. R. H. CURTIS.

PANTAGRAPH ROOM.

April 30, 1879.

During the month of April the following work has been done in this Room:—

Copper Plates have been engraved for the five plates Nos. 4–8, 1879, which include the curves for the 9th of February. In addition a plate of wind diagrams for the Marine Room has been engraved, and about a dozen copies printed.

Zinc Plates have been pantagraphed as follows:—Barograms, 5 plates, Nos. 5–9, 1879; Thermograms, 3 plates, Nos. 7–9, 1879; Anemograms, 6 plates, Nos. 4–9, 1879; Rain Curves, 5 plates, Nos. 4–8, 1879; Vapour Tension, 5 plates, Nos. 4–8, 1879.

Photographic Curves have been ruled and checked to Plate 9 for barograms, and Plate 10 in the case of thermograms. Mr. Cobley, whose time is chiefly occupied with this work, was away from Office, ill, until the 15th of the month.

Examination Work.—The January curves and tabulations were not received until the 17th; they were checked as usual, and the Remark sheets written by the 28th, on which day they were passed to the Land Observatory Room. The February papers have not come to my hands yet.

The small Galton Pantagraph was disabled for a few days owing to a screw giving way, but this did not materially retard the work, as other portions of it could be gone on with whilst the defect was being made good.

R. H. Scott, Esq. R. H. CURTIS.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting 15 logs had been received, 11 of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. A. J. Brown -	Barque "Belleisle."	Nov. 14, 1878—April 18, 1879.	London to Jamaica and back.	1878, p. 40.
Capt. James Buchan	Barque "Commewyne."	Dec. 14, 1878—April 4, 1879.	Glasgow to Surinam and home.	1878, p. 79.
Capt. Hugh Campbell.	Ship "Rajmahal"	Aug. 15, 1878—March 30, 1879.	London to Calcutta and back.	1878, p. 49.
Capt. A. J. Chatfield, R.N.; Staff-Comr. R. Jackson.	H.M.S. "Thunderer."	Oct. 18, 1878—Jan. 31, 1879.	Malta and Artaki Bay -	1879, p. 60. (Lieut. Jackson.)
Capt. Robert Chitham	S.S. "Torrington."	Dec. 23, 1878—April 25, 1879.	Southampton, Batavia, Penang, Marseilles, Rotterdam.	—
Capt. C. D. Coxwell, (F. K. Thimm, 2nd Officer).	S.S. "German"	Feb. 14—May 6, 1879.	Plymouth, Natal, and home.	1879, p. 112.
Capt. J. T. Grant, R.N.; Lieutenant G. N. A. Pollard.	H.M.S. "Malabar."	Feb. 16—May 6, 1879.	Queenstown, Bombay, and home.	1879, p. 109. (Lieut. Pollard.)
Capt. Thos. Mesnard	Ship "Mistley Hall."	Jan. 11, 1878—April 26, 1879.	London, Melbourne, Calcutta, New York, and home.	1877, p, 45.
Capt. Henry Murdoch.	Ship "Denbighshire."	Sept. 24, 1878—Jan. 13, 1879.	London, Otago, San Francisco, and home.	1878, p. 55.
Capt. C. W. Pearson	S.S. "Strathleven."	Nov. 30, 1878—April 6, 1879.	London to Bombay, Bassein, and home.	1878, p. 76.
Capt. Thos. Young -	Ship "City of Agra."	May 29, 1878—April 10, 1879.	London to Melbourne and home.	—

Mr. Scott was instructed to present the Charts (O. 27) to Captains Chitham and Young, and to convey the best thanks of the Council to the other observers.

Read—A Letter (No. 1018) from the Board of Trade, asking for a rain-gauge for Sombrero.

The Secretary was ordered to supply one.

Reported—That William Parsons had been engaged to aid in the distribution of the Forecasts, &c., at 8*s.* per week, for 8 hours work daily.

Reported—That an imprest for 3,375*l.* had been received from the Treasury, April 8, and lodged to the credit of the Council.

SUBMITTED—The following STATEMENT respecting the RECORDS for December 1878, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :—	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Good.	Direction. Fair.	Velocity. Good.
Action														
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	*1 hr.	*3 hrs.	*1 hr.	*1 hr.	0	†43 hrs.	0	0	0	0	0	0	0	0
Orientation verified	7th	—	30th	—	20th	—	7th	—	5th (?)	—	30th	—	12th	—
No. of errors discovered by subsidiaries	0	0	0	2	0	1	7	0	0	0	0	0	1	1
„ „ irregular differences	0	0	0	1	0	0	0	2	10	1	0	0	0	1
Result of 40 *Remeasurements* :—														
Greatest difference	0·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	0·0	1·0
Mean difference irrespective of sign	0·0	0·6	0·0	0·4	0·0	0·6	0·0	0·5	0·0	0·3	0·0	0·4	0·0	0·6
Residual difference (—Meteorological Office)	0·0	—0·2	0·0	—0·1	0·0	+0·2	0·0	+0·1	0·0	0·0	0·0	0·0	0·0	—0·1
RAIN GAUGE :—														
Action	Good.		Fair.		Fair.		Fair.		Good.		Good.		Fair.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		‡3 hrs.		0		0	
Errors in tabulation	0		0		0		7		0		0		4	

BAROGRAPH :—

Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Indifferent.	Do.	Indifferent.	Do.	Do.	Bad.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	§9 hrs.
„ „ other causes	0	0	0	0	0	0	0
No. of errors discovered—							
In entry of standard	0	1	3	3	5	0	0
„ calculating residual correction	0	1	4	4	2	0	0
„ applying residual correction	0	2	0	10	1	0	1
„ subtraction in subsidiary tables	0	0	1	1	1	0	2
„ tabulation by subsidiaries	0	0	0	0	0	0	0
„ „ irregular differences	0	3	0	4	0	0	3
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·005	0·005	0·005	0·003	0·005	0·005
Mean difference irrespective of sign	0·0018	0·0021	0·0025	0·0019	0·0015	0·0024	0·0023
Residual difference (—Meteorological Office)	−0·0001	+0·0007	+0·0011	+0·0001	+0·0002	−0·0002	+0·0007
Mean monthly difference between simultaneous barograph and barometer readings	0·0018	0·0024	0·0020	0·0025	0·0027	0·0016	0·0015

THERMOGRAPH :—

Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Indifferent.		Indifferent.		Bad.		Indifferent.		Do.		Bad.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	1 hr.	0	3 hrs.	0	70 hrs.	73 hrs.	1 hr.	0	0	0	§23 hrs.	§31 hrs.
„ „ imperfectly moistened bulbs	—	0	—	0	—	0	—	0	—	0	—	9 hrs.	—	0
„ „ partially frozen bulbs	—	57 hrs.	—	38 hrs.	—	8 hrs.	—	43 hrs.	—	34 hrs.	—	25 hrs.	—	26 hrs.
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	‖15 hrs.	0	0
No. of errors discovered in entry of standard	1	0	1	0	0	1	0	1	1	6	1	1	0	0
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	0	3	0	1	0	5	14	7	11	0	0	3	1
„ „ detected under glass scale	1	1	7	19	3	3	9	8	15	11	2	3	15	6
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2
Mean difference irrespective of sign	0·11	0·10	0·10	0·10	0·12	0·11	0·09	0·10	0·09	0·10	0·10	0·09	0·09	0·11
Residual difference (—Meteorological Office)	+0·08	+0·05	−0·04	−0·02	+0·10	−0·06	+0·06	0·00	+0·02	+0·03	0·00	−0·05	+0·04	−0·05
Mean monthly difference between simultaneous thermograph and thermometer readings	0·15	0·17	0·19	0·19	0·10	0·10	0·15	0·16	0·19	0·16	0·14	0·12	0·15	0·16
No. of errors in maxima and minima	0	—	2	—	6	—	4	—	8	—	1	—	7	—

* Instrument under repair. † Instrument not working properly. ‡ Instrument not started. § Attributed to bad oil. ‖ Air speck destroyed through using *hot* water to thaw bulb.

SUBMITTED—The following STATEMENT respecting the RECORDS for January 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—	Direction. Good.	Velocity. Fair.	Direction. Good.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Good.	Direction. Fair.	Velocity. Good.
Action														
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	*50 hrs.	0	0	0	0	0	0	0	*107 hrs.	*23 hrs.
Orientation verified	31st	—	28th	—	16th	—	13th	—	1st	—	28th	—	11th & 16th	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	1	1	0	0	0	0	0	0
„ „ irregular differences	0	0	0	0	0	2	0	1	0	0	0	0	0	3
Result of 40 *Remeasurements*:—														
Greatest difference	1·0	1·0	1·0	1·0	1·0	1·0	0·0	1·0	0·0	1·0	0·0	2·0	0·0	1·0
Mean difference irrespective of sign	0·1	0·5	0·0	0·4	0·1	0·4	0·0	0·4	0·0	0·2	0·0	0·4	0·0	0·6
Residual difference (—Meteorological Office)	—0·1	—0·2	0·0	0·0	+0·1	+0·1	0·0	0·0	0·0	0·0	0·0	0·0	0·0	—0·2

RAIN GAUGE:—							
Action	Fair.	Fair.	Indifferent.	Fair.	Fair.	Good.	Fair.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0
Errors in tabulation	0	2	0	2	0	4	0

BAROGRAPH :—

Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Do.	Fair.	Do.	Indifferent.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	0	†9 hrs.	0	0	‡3 hrs.	0	0
No. of errors discovered—							
In entry of standard	1	5	2	8	5	0	0
„ calculating residual correction	0	1	1	2	1	0	0
„ applying residual correction	1	1	0	9	1	0	1
„ subtraction in subsidiary tables	0	1	0	0	3	0	0
„ tabulation by subsidiaries	0	0	0	0	0	0	0
„ „ irregular differences	3	4	1	5	3	0	6
Result of 40 *Remeasurements :—*							
Greatest difference	0·004	0·005	0·005	0·004	0·004	0·003	0·005
Mean difference irrespective of sign	0·0017	0·0017	0·0025	0·0017	0·0021	0·0012	0·0025
Residual difference (— Meteorological Office)	+0·0002	+0·0004	−0·0002	+0·0005	+0·0014	+0·0001	+0·0010
Mean monthly difference between simultaneous barograph and barometer readings	0·0018	0·0022	0·0022	0·0023	0·0026	0·0016	0·0020

THERMOGRAPH :—

Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Indifferent.		Fair.		Bad.		Do.		Indifferent.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	5 hrs.	0
„ „ imperfectly moistened bulbs	—	5 hrs.	—	9 hrs.	—	38 hrs.	—	0	—	126 hrs.	—	33 hrs.	—	0
„ „ partially frozen	—	46 hrs.	—	59 hrs.	—	16 hrs.	—	74 hrs.	—	36 hrs.	—	25 hrs.	—	24 hrs.
„ „ other causes	0	0	0	0	0	0	0	0	0	‡1 hr.	*6 hrs.	*6 hrs.	0	0
No. of errors discovered in entry of standard	0	0	0	0	0	0	2	1	5	1	0	1	0	0
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	0	3	0	1	0	4	4	6	12	0	0	1	1
„ „ detected under glass scale	0	0	1	5	0	5	6	6	19	15	0	3	11	15
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2
Mean difference irrespective of sign	0·11	0·05	0·10	0·11	0·10	0·12	0·11	0·09	0·11	0·11	0·11	0·07	0·11	0·12
Residual difference (— Meteorological Office)	−0·10	+0·02	−0·10	+0·03	+0·01	−0·13	+0·06	−0·04	+0·02	−0·04	+0·03	+0·06	+0·07	−0·09
Mean monthly difference between simultaneous thermograph and thermometer readings	0·11	0·15	0·16	0·18	0·09	0·12	0·13	0·18	0·18	0·25	0·17	0·16	0·13	0·15
No. of errors in maxima and minima	0	—	2	—	5	—	6	—	8	—	1	—	6	—

* Instrument under repair. † Accident to lamp. ‡ Bad photography.

The following cheques for March were drawn on the 29th of that month:—

	£	s.	d.
Administration:			
H. J. S. Smith, Salary	293	15	0
W. De La Rue — Fees	154	8	2
Captain F. J. O. Evans — „	86	12	4
F. Galton — „	150	12	10
Sir J. H. Lefroy — „	154	8	2
G. G. Stokes — „	139	6	10
Special Researches:			
W. Allingham, observations for Captain Hoffmeyer	6	1	3
H. Harries „ „	8	10	0
C. Harding „ „	3	12	10
Office Expenses:			
Williams & Norgate, books	4	7	2
Land Meteorology:			
P. Adie, repairs to S. R. instruments	2	0	0
W. Marriott, meteorological returns	27	10	0
Weather Telegraphy:			
J. J. Hicks, thermometer screens	6	16	6
Ocean Meteorology:			
J. H. Woodstock, packing cases	3	2	3
G. M. Whipple, verifications "A" 1 11 6			
„ „ "B T" 1 9 0			
	3	0	6
P. Adie, repairing A. barometer 5 6 6			
„ „ B T. „ 2 16 6			
„ packing Bermuda Anemometers 3 7 6			
	11	10	6
J. R. Jones, Aberdeen agent	7	7	0
H. J. Thatcher, Cardiff „	8	15	0
P. A. Feathers, Dundee „	6	4	5
J. Gill, Liverpool agent	11	17	2
E. Curtis	3	17	10
E. Gaster	2	7	8
S. A. Harding — Observations for India Office	3	14	6
S. E. Harding	2	1	2
J. E. Harries	4	16	5
R. Mustart, Observations for M. Mascart	2	13	11
Miscellaneous:			
P. Adie, commissions	27	18	0
J. J. Hicks, „	3	2	0
G. M. Whipple „	7	9	0
R. H. Scott, Congress at Rome	80	0	0
Total	£1,227	18	5

The following cheques for April were drawn on the 28th of that month:—

	£	s.	d.
Administration:			
R. H. Scott, salary	66	13	4
Office expenses:			
J. S. Harding, jun.	27	15	6
T. D. Bell — Salaries and wages	12	4	5
J. S. Harding, sen.	* 8	19	8
Carried forward	115	12	11

* Four weeks to the 26th April.

	£	s.	d.
Brought forward - - -	115	12	11
Land Meteorology:			
J. E. Cullum (Valencia), salary - - - - -	15	0	0
R. H. Curtis - }	18	17	9
J. A. Curtis - }	15	11	1
T. E. Allen - } Discussion, &c. of observations - -	15	11	1
C. H. Thompson }	*9	4	0
E. G. Aldridge - }	*7	6	8
Weather Telegraphy:			
F. Gaster - }	29	19	9
W. L. Dallas - }	19	15	1
F. Brodie - } Preparation, &c. of Weather Reports -	17	12	2
H. W. Chivers - }	6	12	0
Ocean Meteorology:			
Captain H. Toynbee - - - - - -	33	6	8
R. Strachan }	27	15	6
C. Harding } Reduction, &c. of observations and care of	20	0	0
H. Harries } instruments - - - -	*11	4	0
J. S. Harding, jun., petty cash - - - - -	120	0	0
„ „ - - - - -	80	0	0
	£563	8	8

The following cheques for April were drawn on the 8th instant:—

	£	s.	d.	£	s.	d.
Special Researches:						
Chance Brothers, glass spheres - - -			-	80	0	0
R. W. Munro, cleaning anemometer - -			-	1	11	6
W. Allingham, observations for Captain Hoffmeyer			-	3	12	8
C. Harding „ „			-	1	10	8
H. Harries „ „			-	2	10	0
Office Expenses:						
Coal Co-operative Society, coals - -			-	2	8	0
Gaslight and Coke Company, gas - -			-	6	10	8
Atkinson & Co., furniture - - -	4	12	0			
„ matting, &c. - - -	5	0	4			
				9	12	4
H. Bond & Son, hire of furniture - -	7	17	6			
„ repairs and gas fittings - -	11	0	3			
				18	17	9
E. Davis & Son „ - -			-	1	5	6
Pickford & Co., carriage of parcels - -			-	1	8	0
E. P. Stringer & Co. „ - -			-	1	16	11
T. Toon, books - - - - -			-	1	4	0
Weather Telegraphy:						
Postmaster General, telegrams - - -			-	194	6	2
F. Dangerfield, delivery of Daily Weather Charts			-	12	6	10
Wightman & Co., printing and wrappers -			-	22	18	9
The Postmaster, Bundoran, Sunday fees -			-	1	1	0
„ Cliffony „ -			-	1	1	0
„ Enniskillen „ -			-	1	2	0
Z. Scaping, erecting instruments at Spurn Point			-	3	1	6
C. G. Squintani & Co., printing press - -			-	12	9	0
Carried forward - -			-	380	11	3

* Four weeks to the 26th April.

	£	s.	d.
Brought forward - - -	380	14	3
Ocean Meteorology :			
L. P. Casella, hygrometer - - - - -	3	15	8
R. W. Munro, wind area instrument - - - -	22	5	0
E. Price-Edwards, advertisements - - - -	1	2	6
J. Worley, freight to Nassau - - - - -	1	0	6
J. H. Woodstock, packing cases - - - -	3	11	6
D. MacGregor & Co., Glasgow agents - - - -	4	10	0
Z. Scaping, Hull agent - - - - - -	3	16	4
S. A. Harding }	2	6	4
J. E. Harries } Copying data books, &c. - - -	2	15	9
R. Mustart - }	4	10	10
Commissions :			
L. P. Casella, D. S. thermometers - - - -	5	0	0
Wightman & Co., forms - - - - -	1	3	0
	£436	11	8

The Council then adjourned.

116, *Victoria Street, May* 22, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	THE HYDROGRAPHER.
MR. GALTON.	PROFESSOR STOKES.

The Secretary was in attendance.

The Minutes of last meeting (May 8) were read and confirmed.

The Secretary submitted the charts of surface temperature and currents for the Pacific for the month of February (Minutes, p. 106). He was instructed to forward the charts to the Hydrographic Department of the Admiralty, with the view of obtaining additional observations for the blank spaces.

The Secretary reported that the thermometers for the sea temperature observations on the coasts of the British Isles (Minutes, pp. 117, 126) were in course of distribution to the stations.

The following form of register and of instructions for taking the sea temperature observations was agreed upon, and the Secretary was instructed to commence the system of observations on the 1st of July:—

OBSERVATIONS of AIR and SEA TEMPERATURE taken at_____ by _____

Rank_____ Thermometer No._____.

Day of Month.	Month of 18 .				Month of 18 .				Month of 18 .			
	Times of Observation.				Times of Observation.				Times of Observation.			
	About Sunrise.		4 P.M.		About Sunrise.		4 P.M.		About Sunrise.		4 P.M.	
	Air.	Sea.	Air.	Sea.	Air.	Sea.	Air.	Sea.	Air.	Sea.	Air.	Sea.
1												
2												
3												
4												
5												
6												
7												
8												
&c. &c. &c.												

INSTRUCTIONS.

I. To observe Air Temperature:—
Place the thermometer for ten minutes or more in the shade in the open air, and then read off.

II. To observe Sea Temperature:—
A. At Land Station, if possible, select a place where the water is not less than six feet deep, plunge the thermometer one foot under water, and keep it there for two or three minutes, then take the thermometer out and promptly read off.
B. At Ship Station, proceed as at Land Station; or, if more convenient, draw bucket of water from alongside, place the thermometer in it for two or three minutes, then take the thermometer out and promptly read of.

A form of screen for exposure of thermometers in air temperature observations was submitted, and it was resolved that the screen should be tested at Kew, after certain alterations had been made in it.

SUBMITTED—The following STATEMENT respecting the RECORDS for February 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
Action - - - - - -	Good.	Fair.	Good.	Fair.	Good.	Good.	Fair.	Fair.	Good.	Good.	Fair.	Fair.	Fair.	Good.
Records deficient, due to stoppage of clock -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes -	0	0	0	0	0	0	0	0	0	0	0	0	†20 hrs.	†24 hrs.
Orientation verified - - - - -	—	—	27th	—	17th	—	8th	—	11th	—	26th	—	14th	—
No. of errors discovered by subsidiaries -	0	0	1	0	0	1	0	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	0	0	0	0	1	0	1	0	0	0	2
Result of 40 *Remeasurements*:—														
Greatest difference - - - - -	0·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	0·0	1·0	1·0	1·0	0·0	2·0
Mean difference irrespective of sign - -	0·0	0·4	0·0	0·6	0·0	0·4	0·0	0·3	0·0	0·5	0·0	0·4	0·0	0·5
Residual difference (— Meteorological Office) -	0·0	+0·2	0·0	0·0	0·0	0·0	0·0	+0·1	0·0	0·0	0·0	+0·1	0·0	+0·1
RAIN GAUGE:—														
Action - - - - - -	Good.		Fair.		Indifferent.		Fair.		Fair.		Good.		Fair.	
Records deficient, due to stoppage of clock -	0		0		0		0		0		0		6 hrs.	
„ „ other causes - -	*98 hrs.		0		0		0		0		0		0	
Errors in tabulation - - - -	0		0		0		1		4		1		3	

BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good	Good.
Photography	Do.	Do.	Bad.	Do.	Do.	Do.	Do.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	2 hrs.
„ „ failure of light	0	0	1 hr.	0	0	1 hr.	0
„ „ other causes	0	0	0	0	‡5 hrs.	0	0
No. of errors discovered—							
In entry of standard	0	0	2	2	3	1	1
„ calculating residual correction	0	0	3	3	1	0	0
„ applying residual correction	0	1	0	6	0	0	0
„ subtraction in subsidiary tables	1	0	0	2	1	1	2
„ tabulation by subsidiaries	0	2	0	0	0	0	0
„ „ irregular differences	1	2	0	1	7	0	0
Result of 40 *Remeasurements :—*							
Greatest difference	0·006	0·010	0·006	0·006	0·010	0·006	0·005
Mean difference irrespective of sign	0·0019	0·0030	0·0026	0·0024	0·0023	0·0020	0·0023
Residual difference (— Meteorological Office)	+0·0007	+0·0014	+0·0002	−0·0001	+0·0006	+0·0012	+0·0005
Mean monthly difference between simultaneous barograph and barometer readings	0·0018	0·0025	0·0020	0·0023	0·0027	0·0018	0·0016

THERMOGRAPH :—														
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Indifferent.		Do.		Do.		Do.		Indifferent.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	1 hr.	0	0	0	0	0	6 hrs.	6 hrs.	0	0	2 hrs.	14 hrs.
„ „ imperfectly moistened bulbs	—	0	—	0	—	20 hrs.	—	24 hrs.	—	16 hrs.	—	18 hrs.	—	0
„ „ partially frozen	—	55 hrs.	—	23 hrs.	—	0	—	19 hrs.	—	51 hrs.	—	42 hrs.	—	0
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard	0	1	1	0	0	0	2	1	2	0	0	0	0	0
„ „ by subsidiary measurements	0	0	0	0	1	0	0	1	2	1	0	0	0	0
„ „ of subtraction in do. tables	0	0	0	0	0	0	3	2	6	9	1	0	1	0
„ „ detected under glass scale	0	0	1	2	2	3	0	2	5	3	0	1	16	21
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·2	0·2	0·4	0·3	0·3	0·2	0·4	0·3	0·3	0·2	0·3	0·6	0·5
Mean difference irrespective of sign	0·06	0·08	0·11	0·11	0·07	0·11	0·08	0·09	0·09	0·12	0·05	0·15	0·14	0·18
Residual difference (— Meteorological Office)	−0·05	−0·01	−0·06	+0·06	−0·02	+0·10	+0·05	−0·08	−0·02	+0·02	+0·02	+0·13	+0·11	−0·17
Mean monthly difference between simultaneous thermograph and thermometer readings	0·12	0·15	0·14	0·12	0·08	0·10	0·16	0·15	0·12	0·11	0·17	0·16	0·15	0·17
No. of errors in maxima and minima	1	—	5	—	1	—	9	—	5	—	1	—	12	—

* Instrument under repair. † Cylinder caught. ‡ Fingermarks destroying trace.

The question of the issue of the Forecasts was resumed (Minutes, p. 5). It was suggested that an application should be made to Government to forward the 4h. p.m. Forecasts to the Postal Telegraph Offices, for exhibition in their windows: or otherwise to give special facilities for the publication of Forecasts likely to be useful to agriculturists.

After discussion the further consideration of this suggestion was postponed; but it was agreed that in certain cases, and as a tentative experiment, the Office itself might supply information free of charge to persons interested in the approaching hay harvest, and that the Secretary of the Royal Agricultural Society be consulted as to the districts to be selected for such special communications.

Resolved—(1.) That a specimen Forecast for the 11 districts be prepared and circulated among the members of Council.

(2.) That the charge for Forecasts be 10*s*. per annum, in addition to the cost of transmission by messenger, telegraph, and letter or book post.

(3.) That from and after July 1 the subscription for the joint issue of Daily Weather Chart and Forecast be 25*s*. per annum.

(4.) That during the current year, 1879, the 4 p.m. Forecasts be issued without extra charge to all subscribers to the Daily Weather Charts who have paid their subscription, and whose copies are posted at the Meteorological Office, and that the 11 a.m. Forecasts be issued with all copies of the charts distributed by Messrs. Dangerfield.

(5.) That these arrangements shall not modify existing terms for the issue of Forecasts by hand, or to newspapers.

Reported—That the amount payable by the Post Office for Forecast inquiries in the month of April had been 1*l*. 8*s*.

Submitted—The following correspondence:—

M.O. 1167.

MON CHER MONSIEUR SCOTT, Paris, Mai 17, 1879.

J'AI mis à la poste à votre adresse un exemplaire des feuilles de bord que nous allons donner à la marine marchande pour y faire, comme sur les navires de l'Etat, des observations simultanées supplémentaires. J'aurais voulu pouvoir porter à Rome quelques uns de ces journaux, mais vous recevrez le premier qui m'ait été fourni par l'imprimeur.

Par la première simultanée (12h. 53m. de Paris), nous pourrons concourir aux observations d'ensemble organisées par le Signal Service; la seconde (6h. 53m.) nous permettra j'espère de mieux établir la continuité des phénomènes. MM. Hoffmeyer et Neumayer ayant entrepris un travail qui ferait double emploi avec l'Atlas des Mouvements Généraux tels que l'avait conçu Le Verrier, j'ai pensé qu'il valait mieux porter nos efforts d'un autre côté. J'ai lieu de croire que, sans porter ombrage à personne, nous pourrons ainsi contribuer pour notre part au progrès de la météorologie générale. Il va sans dire que les observations terrestres seront nécessaires pour relier l'ensemble des documents.

Pour les Iles Britanniques en particulier, il nous faudrait trois ou quatre observations en Irlande, cinq en Ecosse et dans les îles voisins, et une dizaine en Angleterre. Cette simultanée tomberait chez nous entre 6h. 5m. et 6h. 50m.

Je voudrais donc vous demander deux choses:—

1°. Si le Meteorological Office serait disposé à nous communiquer régulièrement copie d'observations relatives au baromètre, thermomètre, ciel et vent pour cette simultanée de 6h. 53m. (T. M. de Paris) dans un certain nombre de stations, telles que Mullaghmore, Scarboro, Yarmouth, Saint Anns, Aberdeen, Falmouth, Kew, Valentia, ou plutôt dans des stations équivalentes dont vous feriez le choix, et où il suffirait souvent de consulter les enregistreurs.

2°. Quelques renseignements sur les établissements et les personnes à qui je pourrais m'adresser utilement pour obtenir des observations analogues, afin de compléter le réseau.

Ainsi, je crois qu'en Ecosse, la plupart des stations adressent leurs observations à Mr. Buchan. De même, en Angleterre il y a plusieurs observatoires privés où l'on suit avec régularité les phénomènes météorologiques, etc.

Nous ne sommes pas grands seigneurs en météorologie, comme les Etats Unis, et nous ne pouvons guère offrir aux observateurs, en récompense de leur concours, que l'expression de notre reconnaissance. Toutefois, j'espère qu'il nous sera facile d'adresser à chacun un exemplaire des travaux de météorologie générale auxquels il aura contribué. Ce sera au moins une preuve de notre bonne volonté.

Votre bien dévoué,
(Signed) E. MASCART.

1249.

MY DEAR MONSIEUR MASCART, Meteorological Office, May 19, 1879.

YOUR letter is quite formal enough to be laid before the Council on Thursday, if you do not object. I am exceedingly obliged to you for sending me such an early copy of the form of log.

There will be some difficulties in obtaining readings twice a day at hours which do not accord with ordinary observation epochs.

If you could accept readings from our self-recording observatories, you can get them for any hour or minute.

At all events the plan shall be considered with the greatest care.

Yours, &c.
(Signed) ROBERT H. SCOTT.

M.O. 1193.

MON CHER MONSIEUR SCOTT, Paris, Mai 27, 1879.

SI vous trouvez ma précédente lettre suffisante pour être présentée au Meteorological Council, je vous serai très obligé de le consulter sur cette question.

Je sais bien que c'est toujours difficile de demander aux observateurs autre chose que ce qu'ils ont l'habitude de faire, mais dans les observatoires bien organisés cette lecture de 6h. 53m. tombe à un moment où j'espére qu'elle ne produira pas un grand dérangement. Partout où il y a des inscripteurs, il suffira, bien entendu, de consulter les courbes, ce qui réduira la besogne à très peu de chose.

Votre bien dévoué,
(Signed) E. MASCART.

The Secretary was instructed to offer to supply readings from the self-recording instruments for 6h. 53m. p.m. for all the observatories or as many of them as M. Mascart may desire, and in addition readings for 6 p.m. from any stations which may suit M. Mascart's purpose.

Mr. Galton submitted proofs of his Current Charts (Minutes, p. 5).

It was resolved that an assistant should, if possible, be found for Mr. Stodart (the engraver), in order to enable him to carry on the "biting" and "proving" of the Wind Chart plates in the Office, without interference with the progress of the Quarterly Weather Report plates.

Submitted—Mr. Ley's draft scheme for "Cirrus" observations (Minutes, p. 2), which was ordered to be printed.

Submitted—Mr. Perry's completed discussion of the Kerguelen observations (Minutes 1878–9, pp. 32, 37, 79), which was ordered to be printed as a separate paper in 4to.

Submitted—An application from the Secretary of the Parkes Museum of Hygiene for the publications of the Office (Letter 1149). The Secretary was instructed to supply the Weekly Weather Report gratis to the Parkes Museum.

Read—A memorandum from Captain Toynbee reporting that since the last meeting three logs had been received, two of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. W. Barron -	S.S. "Sultan" -	Jan. 7—May 10, 1879.	Hull to Hamburg, eight voyages.	1878, p. 109.
Capt. G. Shearer -	Ship "Early Morn."	May 13, 1877 to April 16, 1879.	Cardiff, Negapatam, Rangoon, and home.	1877, p. 31.

Mr. Scott was instructed to convey the best thanks of the Council to the above observers.

Mr. Scott reported that he had ascertained that an observer could be found at Hawes Junction, near Settle (Minutes 1878–9, pp. 119, 129), (Letter 1131). He was authorised to apply to the directors of the Midland Railway for permission to establish the station.

Submitted—The following letters, which were ordered to be placed upon the Minutes:—

DEAR SIR GEORGE AIRY, Lensfield Cottage, Cambridge, April 30, 1879.

I WAS greatly struck with the enormous amount of work of which the outcome is embodied in the "Reduction of Greenwich Meteorological Observations" which I lately received, and with

the very definite character of the results arrived at. My admiration was not unmixed with some anxiety, lest after all the Thomson's harmonic analyser, which we have ordered for the Meteorological Office, should be capable only of giving results which by comparison must be regarded as of the "cheap and nasty" class.

I thought, therefore, that I would test its applicability in a severe case ; I mean of course the applicability of the principle, the machine being supposed to be properly constructed, and to work satisfactorily.

I chose the observations of temperature rather than those of the barometer, because the manifest discontinuity introduced by sunrise and sunset seemed to render temperature a more severe test than height of the barometer. As I explained in a former letter, the greater the number of observations of which the mean is taken, the greater the superiority, if any, of the method of hourly means over the harmonic method is likely to prove.

These motives led me to select for trial the last column of Table 50, page 38. I did my work pretty carefully, but I have not revised it, so that it is possible that there may be an arithmetical error, but I do not think it at all likely that the general conclusions would be affected. I went as far as the sixth order. I had contemplated going further, but it did not seem necessary.

I determined the coefficients in the usual way. I may remark in passing that this does not give them correctly in the high orders. Each is, by rights, given by an integral, which is only approximately represented by a sum, and in the high orders the difference would be very sensible. I had some thoughts of working them out correctly, but the high orders proved to be so small as to render this unnecessary.

Denoting by t an angle proportional to the time, measured from midnight, and going through its period in 24 hours, I found temperature = 49·69

$-4\cdot280\cos t$	$-2\cdot722\sin t$
$+0\cdot883\cos 2t$	$+0\cdot563\sin 2t$
$+0\cdot063\cos 3t$	$+0\cdot119\sin 3t$
$-0\cdot043\cos 4t$	$-0\cdot014\sin 4t$
$-0\cdot001\cos 5t$	$-0\cdot026\sin 5t$
$-0\cdot003\cos 6t$	$-0\cdot008\sin 6t$

For the coefficients in the different orders when the two terms are combined into one we get :

	5·072	1·047	0·135	0·045	0·026	0·009
Orders	1	2	3	4	5	6

It appears then that the first three orders give the result within about 1 per cent. of the whole diurnal variation. The error would be only a few hundredths of a degree.

I made an attempt to estimate the errors of the published numbers, by which I mean the difference between the published numbers which represent what I called, in a former letter, the mean of fact, and what I there called the mean of law; in other words, what would be the mean of an infinite series.

For this I chose two months, January and July, and two hours, midnight and noon. In Tables 38 and 44 I took the differences between the numbers in the midnight and noon columns and the means at the feet of the columns, and regarding those as errors I took their mean. The means were 2·475 and 2·500 for January ; 1·610 and 1·710 for July ; mean 2·074. As Table 50 gives the means for 240 months, I divided the result by the square root of 240, giving 0·134. This, then, we may take as a sort of estimate of the residual errors in the last column of Table 50 arising from the finiteness of the series, great though it was. It is about equal to the greatest value of the terms of the Order 3 in the periodic series.

I noticed, however, in working these figures that on the whole midnight and noon went together, so that the "errors" that I have spoken of arose more from variations of temperature from day to day, or week to week, than from variations within the same day. I therefore took the differences between the midnight or noon column and the last column but one, which gives the monthly mean of the mean temperature of the day. I meaned each vertical column, and took the differences between the mean and the individual numbers, and regarded these as the errors. The means came 0·28 and 0·33 for January ; 0·78 and 1·20 for July ; mean 0·65 ; same divided by the square root of 240, 0·042. This is almost exactly the coefficient of the fourth order.

It appears that the harmonic method has come very well out of its trial in a case purposely selected as being likely to be the most severe. It appears, too, that we need not trouble ourselves to go beyond the third order. The third order itself hardly emerges from casual fluctuations.

Of course the harmonic method would not *by itself alone* give such non-periodic results as those represented in Plate 4, but the modification required to introduce these is very simple.

Yours, &c.

G. G. STOKES.

DEAR SIR GEORGE AIRY, Lensfield Cottage, Cambridge, May 10, 1879.

I HAVE made some further calculations in pursuance of the subject mentioned in my letter of April 30, the results of which you might perhaps like to know.

From the numerical trials described in that letter, I was led to infer that the uncertainty of the diurnal inequality of temperature expressed by the differences between the numbers in the last column of Table 50 and the number at the foot of the column was something like 0·04, and accordingly of about the same magnitude as the term of the fourth order in the harmonic reduction. The uncertainty I contemplate as arising from the uneliminated residue of casual fluctuations, whereby the actual temperature at any observation differs from the mean really belonging to that day and hour.

If we can only regard the differences between the means in the last column of Table 50 and the ide l means for an infinite series as casual, it is clear that the harmonic reduction when carried to the third order will represent the result as nearly as the latter represents the ideal mean that we are seeking for. But it occurred to me that the fluctuations indicated in my former letter might be fluctuations arising rather from the coefficient than from the law of diurnal variation, in which case, though the absolute mean of fact for any hour might deviate from the ideal mean to an extent comparable with 0·04, the law of variation might possibly be a good deal more correctly given. In this case the harmonic reduction, as compared with the other, would show a minute inferiority, unless at least it were carried to orders beyond the third, though the error is so small that it is hard to imagine that any scientific conclusion that could be drawn from the observations would be interfered with. Still, I was desirous of ascertaining whether even a minute error of the harmonic reduction taken to the third order, large enough to emerge from casual fluctuations, could be discovered.

It occurred to me that this point could be decided by taking separate years or groups of years instead of the whole series of 20 years, expressing the means for the separate years or groups in a harmonic series, and comparing the coefficients with those got from the whole 20 years series. If the fluctuations indicated in my former letter depended mainly on fluctuations in the coefficient of diurnal variation, the law being but little departed from, the changes in the coefficients of the several terms in the series should bear some sort of proportion in magnitude to the coefficients themselves, so that the leading terms should be those chiefly affected, a variation like one per cent. being insensible in the small terms; whereas if the fluctuations affected the law as much as the mere amount of diurnal variation, no such subordination of the higher to the lower orders in regard to the changes of the coefficients was to be expected.

The published volume does not contain a table for air temperature analogous to Table19, or better, to Table 20 for the barometer. Of course it could be formed from the published numbers by meaning Tables 38 to 49 as if they had been superposed, and the means taken of the numbers that lay one over the other. But this would involve more labour than I was disposed to go through. So I had recourse to a plan which practically, I think, suffices for determining the question, and which permits of utilising an existing table.

I took Table 51 and made three groups of the months, the months of each group being equidistant. I meaned the numbers in each group, or rather added them, reserving the division to the end. In this way the seasonal inequality would be pretty completely eliminated, and the results would not much differ in character from those got from dividing the 20 years into three groups, and seeing how far each group agreed with its fellows. Instead of working with the actual numbers of the table, I preferred taking the difference between the number for each group, and the mean of the three. Subjecting these differences to harmonic reduction, I obtained :—

$$
\begin{array}{ll}
+\ 0\cdot006\cos t & +\ 0\cdot022\sin t \\
+\ 0\cdot019\cos t & -\ 0\cdot009\sin t \\
-\ 0\cdot025\cos t & -\ 0\cdot015\sin t \\
 & \\
+\ 0\cdot014\cos 2t & -\ 0\cdot004\sin 2t \\
-\ 0\cdot026\cos 2t & +\ 0\cdot025\sin 2t \\
+\ 0\cdot011\cos 2t & -\ 0\cdot021\sin 2t \\
 & \\
-\ 0\cdot000\cos 3t & -\ 0\cdot007\sin 3t \\
+\ 0\cdot006\cos 3t & -\ 0\cdot004\sin 3t \\
-\ 0\cdot006\cos 3t & +\ 0\cdot011\sin 3t \\
 & \\
-\ 0\cdot008\cos 4t & +\ 0\cdot008\sin 4t \\
+\ 0\cdot016\cos 4t & +\ 0\cdot030\sin 4t \\
-\ 0\cdot007\cos 4t & -\ 0\cdot042\sin 4t
\end{array}
$$

I have written the numbers according to orders, and the groups in the several orders on consecutive lines, so that the development of the first group, for instance, is made up of the first lines in the several orders. For the coefficients of the different orders when the two terms of the same order are combined into one I get :

Order -	- 1	2	3	4	
Coefficient -	0·023	0·015	0·007	0·011	G. 1
	0·021	0·036	0·007	0·034	G. 2
	0·029	0·024	0·013	0·043	G. 3

There is no such subordination of magnitude of the coefficients in the higher orders to those in the lower as must have taken place on the supposition that the deviations from the ideal mean arose chiefly from deviations from the mean coefficient, not from the law, of diurnal variation. The

inference is that the small deviations in question, amounting to a few units in the second place of decimals, can only be treated as casual; and as they are comparable with the coefficient of the fourth order given in my former letter, it follows that the harmonic series taken to the third order will represent the results of observation within their limits of error. The small coefficient of the third order itself can only be deemed to be determined from the observations subject to an error amounting to 30 or 40 per cent. of the whole.

I noticed in taking the difference of the group numbers from the mean of the three that the differences ran very much in series of plus and minus. They exhibited considerable regularity. I rather expected from this that the harmonic series would have been most significant in the leading terms, but such proved not to be the case. However, the regularity of the fluctuations indicates that the uneliminated errors are not such as would be got by the throwing of dice for the different hours independently of each other, but that the fluctuations from which they arise are such as extend their influence over several hours at a time. This character, even had their amount been larger, would have prevented them from interfering much with the smoothness of the mean curve obtained, so that smoothness of curve is not by itself alone a proof that we have got very near the ideal mean.

I asked Mr. Ellis on Thursday whether the means for air temperature analogous to those given for the barometer on page 18 existed in MS. at the Royal Observatory, but from his answer to my inquiry I find they do not. I do not think it would be worth while to calculate them, for though they would afford the readiest means of determining the probable error of the means given in Table 50, last column, a sufficiently close estimate may be formed in other ways.

I should mention that my Group 1 is made up of January, April, July, and October, and 2, 3 are similarly formed beginning with February and March respectively.

Yours sincerely,
G. G. STOKES.

Sir George B. Airy, K.C.B.,
Astronomer Royal.

The Council then adjourned.

116, *Victoria Street, June* 6, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | THE HYDROGRAPHER.
MR. GALTON. | PROFESSOR STOKES.
LIEUT.-GENERAL STRACHEY.

The Secretary was in attendance.

The Minutes of last meeting (May 22) were read and confirmed.

The form proposed for the Daily Forecasts was submitted, as directed at last meeting. The Secretary was instructed to submit a final proof on the 13th instant, so as to be ready to commence the issue of the Forecasts without delay.

The Secretary reported that he had had an interview with Mr. H. M. Jenkins, the Secretary of the Royal Agricultural Society, who had suggested the following list of gentlemen interested in agriculture as persons who might be willing to receive the Forecasts during the coming hay season, with the view of testing their usefulness to farmers :—

District.	County.	Telegrams to be addressed to	Address.
N.E. (No. 2) -	Northumberland -	Jacob Wilson - - -	Woodhorn Manor, Morpeth.
	Durham - -	W. Scarth - - -	Raby Castle.
	Yorkshire - -	G. H. Sanday - - -	Wensley House, Bedale.
	Lincolnshire -	W. Frankish - - -	Limber Magna, Ulceby.
E. (No. 3) -	Norfolk - -	E. Beck, jr. - - -	Sandringham, King's Lynn.
	Suffolk - -	R. C. Ransome - - -	Ipswich.
	Herts - -	J. B. Lawes - - -	Rothamsted, St. Albans.
	Essex - -	D. McIntosh - - -	Havering Park, Romford.
Midland (No. 4)	Nottingham -	J. Hemsley - - -	Shelton, Newark.
	Shropshire - -	J. Bowen Jones - -	Ensdon House, Montford Bridge, R.S.O.
	Gloucestershire -	Royal Agricultural College	Cirencester.
	Oxford - -	Major Dashwood - -	Kirtlington, Oxford.
South (No. 5) -	Kent - - -	C. Whitehead - - -	Barming House, Maidstone.
	Bucks and Berks	J. R. Fowler - - -	Prebendal Farm, Aylesbury.
	Hampshire - -	Sir F. Fitzwygram, Bt. (Major-General).	Leigh Park, Havant.
	Wiltshire - -	E. P. Squarey - - -	Downton, Salisbury.
N.W. (No. 7) -	Lancashire -	A. Ashforth - - -	Egerton Hall, Bolton.
	Anglesea - -	R. Humphreys - - -	Beddgelert, Carnarvon.
	Montgomery -	Earl Powis - - -	Powis Castle, Welshpool.
	Cheshire - -	D. R. Davies - - -	Agden Hall, Lymm, Cheshire.
S.W. (No. 8) -	Pembroke - -	Earl Cawdor - - -	Stackpole Court, Pembrokeshire.
	Somerset - -	T. Dyke - - - -	Long Ashton, Bristol.
	Devon - -	Sir T. Dyke Acland, Bt. -	Sprydoncote, Exeter.
	Cornwall - -	W. Trethewy - - -	Tregoose, Grampound Road, Cornwall.

The Secretary was instructed to communicate with the gentlemen named by Mr. Jenkins, and also with Mr. Buchan and with the Secretary of the Royal Dublin Society, with the view of obtaining the names of gentlemen resident in Scotland and Ireland to whom Forecasts might be similarly addressed.

It was agreed that Forecasts should be forwarded, free of charge, to the Royal Agricultural Society during the proposed Show at Willesden.

The Secretary was instructed to report to the Council at next meeting as to suitable places in the City, and elsewhere in London, at which the Forecasts might be exhibited publicly.

Reported that the "Daily News" had agreed to receive the 8 p.m. Forecasts, and to pay for them at the rate of 300*l.* per annum (Minutes, p. 4).

The Secretary was instructed to report at next meeting on the improvement of the afternoon reports.

Resolved—That the Chairman and Secretary apply for an interview with the Postmaster-General with the view of obtaining increased facilities for the transmission of Meteorological information by telegraph and post.

Mr. De La Rue reported that the signalling anemometer (Minutes, 1878, p. 120) had been repaired under his direction, and returned by his instructions from Messrs. Negretti and Zambra.

He had had the gearing re-arranged, and the number of revolutions of the vertical shaft necessary to diverge the governor balls determined. See Negretti and Zambra's letter, June 3, 1879.

The anemometer would signal from 32·75 to 40·19 miles per hour.

Resolved—That the instrument be replaced on Queen Ann's Mansions, and if possible in a more favourable position than before.

The Draft Report for 1878–9 was submitted and discussed. It was ordered that a revise should be prepared to be finally considered at next meeting.

Read—A memorandum from Captain Toynbee reporting that since the last meeting six logs had been received, three of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. F. S. Clayton, R.N.	H.M.S. "Rifleman."	Nov. 5, 1878—Mar. 27, 1879.	On the East Indian Station.	——
Capt. E. W. Turner	Barque "Mertola"	Nov. 7, 1878—May 23, 1879.	Liverpool to Pomaron -	1878, p. 49.
Capt. W. J. L. Wharton, R.N. Lieut. G. C. Frederick	H.M.S. "Fawn"	Jan. 1—April 30, 1879.	Surveying in the Sea of Marmora.	1878, p. 122.

Mr. Scott was instructed to present the Charts (O. 32) to Captain Clayton and to convey the best thanks of the Council to the other observers.

Submitted the following Reports:—

M.O. 1290. PANTAGRAPH ROOM. May 31, 1879.

THE following is a statement of the progress made during the month of May with the preparation of the Quarterly Weather Report plates for 1879:—

Copper Plates.—During the month 7 plates have been pantagraphed, Nos. 9 to 15, bringing the data up to March 16th, the last three of these are, however, still in the engraver's hands.

Zinc Plates have been pantagraphed as follows:—

Barograms	6 plates	Nos. 10 to 15
Thermograms	7 „	„ 10 „ 16
Anemograms	8 „	„ 10 „ 17
Rain Curves	8 „	„ 9 „ 16
Vapour Tension	7 „	„ 9 „ 15

Photographic Curves have been ruled and checked up to plate 16 for Barograms (not quite completed), and plate 17 for Thermograms.

The remark sheets have been written and the work checked for the month of February. The tabulations were received from Mr. Allen on the 6th and passed to the Computing Room on the 14th. The March work was received from Mr. Allen on the 21st, but has not yet been examined; it will however be taken in hand at once. Mr. Allen's report is attached.

The engraver has been occupied for a short time, once or twice during the month, on work for the Marine Room.

R. H. Scott, Esq., F.R.S. R. H. CURTIS.

M.O. 1290.

EXAMINATION ROOM, LAND OBSERVATORIES DEPARTMENT.

SIR, May 23, 1879.

AT the date of the last report (April 24th), the work for *February* and *March* was in hand; since then it has been completed and handed into the Pantagraph Department, and the work for *April* steadily proceeded with.

Of the work for April, part of the thermograms for all stations is done, and a very slight amount of the barograms and anemograms.

The long winter has been very much against the work of the room, but with April, commences work of a more favourable character of which every advantage will be taken to work off the arrears.

R. H. Scott, Esq., M.A., F.R.S. T. E. ALLEN.

M.O. 1290.

STATEMENT of WORK done in MARINE ROOM during May 1879.

June 6, 1879.

New logs examined.—11 in number.

Winds for 3 Nn. Cape squares—sum of forces being worked to replace mean force in results for single-degree square.

Winds for 3 Sn. Cape squares, the tabulation from Data Books for *M.O.* Logs about one half completed.

Wind-area Instrument.—A clerk trained to work instrument. April plate engraved for 3 Nn. Cape Squares, and other specimens prepared.

Cape Gale Tables.—Specimen plates drawn containing various diagrams by which Captain Toynbee proposes to illustrate the general discussion for January.

Little or no progress made with the tabulation of gales for other months.

Collection of Data for Cape of Good Hope.—The extraction of Dutch observations completed, Of 40,870 observations received we have "extracted" 36,320 into the Data Books for South of 40° S. in the Cape of Good Hope District, the remaining 4,550 are not available for extraction.

Pacific Charts of Sea Temperature and Currents.—February Chart completed for M.O. Logs, the number of Logs plotted is 156.

May Charts prepared and plotting well in hand.

Collection of Meteorological Data in Indian Ocean.—The extraction of data for July to December fairly commenced.

(The data for February to June not yet forwarded to India, waiting an examination of Data Books.)

CHARLES HARDING.

R. H. Scott, Esq.

Submitted—The following Abstract of Accounts from 1st April 1878 to 31st March 1879:—

INCOME.	£	s.	d.
Vote for the year 1878–79	14,500	0	0
SUPPLY OF INFORMATION:—			
Weather information supplied for newspapers, &c.	384	17	3
Repayments for telegrams, subscriptions for Daily Weather Charts, &c.	840	4	0
Ocean statistics supplied	361	0	3
Miscellaneous information supplied	5	18	0
SALE OF INSTRUMENTS, &c.:			
Mercantile Marine account	59	19	1
Royal Navy account	83	18	3
Repayments of expenses charged under:—			
(1) Incidental expenses	26	8	3
(2) Observatories and other stations	18	1	3
Commission charged for work done for Colonies	30	2	8
	£16,310	9	0

EXPENDITURE.	£	s.	d.
Balance from year 1877–78	43	16	1
Council	1,000	0	0
Secretary	800	0	0
Special researches and experiments	775	3	11
Salaries and wages (Office expenses)	712	10	8
Rent, fuel, and lighting	578	12	10
Furniture, &c.	14	12	11
Incidental and contingent expenses	394	17	6
Observatories and other stations	2,438	13	9
„ (new instruments)	92	0	0
Discussion and reduction of observations (land)	1,361	19	0
Telegrams, storm warnings, and reporters	3,104	2	8
Inspectors	295	0	1
Preparation, issue, and discussion of Weather Reports	1,266	4	4
Royal Navy: supply of instruments	399	12	2
„ other expenses	10	2	7
Mercantile Marine: supply of instruments	275	19	0
„ other expenses	246	19	3
Distant stations (expenses and discussions)	53	2	10
Reduction and discussion of observations (ocean) and care of instruments	1,737	9	7
Balance	709	9	10
	£16,310	9	0

LIABILITIES.	£	s.	d.
To Post Office (partly estimated)	381	11	2
„ sundry creditors	423	9	11
„ „ (contracts or work uncompleted)	596	8	0
„ balance	709	9	10
	£2,110	18	11

ASSETS.	£	s.	d.
By cash at bank	1,435	12	7
„ „ at Office	241	12	6
„ „ at Valencia	50	0	0
„ sundry debtors	383	13	10
	£2,110	18	11

SUBMITTED—The following STATEMENT respecting the RECORDS for March 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

——	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:— Action	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Fair.	Direction. *Fair.	Velocity. Good.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0	0	0	†2 hrs.	0	0	*205 hrs.	*2 hrs.
Orientation verified	1st	—	31st	—	12th	—	8th	—	3rd	—	27th	—	8th &18th	—
No. of errors discovered by subsidiaries	0	0	2	0	0	0	0	0	0	0	0	0	0	0
„ „ irregular differences	1	0	0	6	1	0	0	3	0	0	0	2	0	3
Result of 40 *Remeasurements*:—														
Greatest difference	1·0	1·0	0·0	1·0	0·0	1·0	0·0	1·0	0·0	2·0	1·0	1·0	0·0	2·0
Mean difference irrespective of sign	0·1	0·4	0·0	0·6	0·0	0·4	0·0	0·3	0·0	0·5	0·0	0·5	0·0	0·7
Residual difference (— Meteorological Office)	0·0	0·0	0·0	+0·1	0·0	−0·1	0·0	0·0	0·0	0·0	0·0	0·0	0·0	−0·1
RAIN GAUGE:— Action	Fair.		Fair.		Fair.		Fair.		Fair.		Good.		Fair.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		0		0		0	
Errors in tabulation	0		0		0		0		0		0		0	

BAROGRAPH :—

Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Indifferent.	Do.	Fair.	Do.	Do.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	0	0	‡1 hr.	0	§43 hrs.	0	0
No. of errors discovered—							
In entry of standard	0	1	4	3	3	0	0
„ calculating residual correction	0	0	3	1	1	0	0
„ applying residual correction	0	0	1	4	0	0	3
„ subtraction in subsidiary tables	0	0	0	2	1	0	2
„ tabulation by subsidiaries	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	4	7	0	8
Result of 40 *Remeasurements :—*							
Greatest difference	0·004	0·005	0·005	0·009	0·005	0·005	0·011
Mean difference irrespective of sign	0·0016	0·0025	0·0029	0·0027	0·0026	0·0029	0·0027
Residual difference (—Meteorological Office)	+0·0002	+0·0012	+0·0010	+0·0005	+0·0016	+0·0020	−0·0001
Mean monthly difference between simultaneous Barograph and Barometer readings	0·0018	0·0023	0·0021	0·0024	0·0023	0·0015	0·0014

THERMOGRAPH :—

Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Do.		Do.		Do.		Do.		Fair.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	0	2 hrs.
„ „ imperfectly moistened bulbs	—	78 hrs.	—	0	—	7 hrs.	—	42 hrs.	—	45 hrs.	—	61 hrs.	—	0
„ „ partially frozen bulbs	—	25 hrs.	—	32 hrs.	—	5 hrs.	—	17 hrs.	—	23 hrs.	—	20 hrs.	—	0
„ „ other causes	0	0	0	0	0	0	0	0	1 hr.	†1 hr.	0	0	0	0
No of errors discovered in entry of Standard	0	0	2	0	0	0	1	0	0	0	0	0	0	0
„ „ by subsidiary measurements	0	0	0	3	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	0	0	0	0	0	5	2	2	3	0	0	1	2
„ „ detected under glass scale	1	1	5	1	3	2	0	3	4	5	1	6	11	4
Result of 40 *Remeasurements :—*														
Greatest difference	0·3	0·3	0·3	0·2	0·2	0·3	0·2	0·3	0·3	0·2	0·2	0·3	0·3	0·4
Mean difference irrespective of sign	0·10	0·11	0·10	0·09	0·10	0·12	0·10	0·10	0·11	0·11	0·09	0·09	0·14	0·11
Residual difference (—Meteorological Office)	−0·09	+0·08	−0·10	+0·06	−0·05	+0·10	+0·04	−0·05	−0·03	+0·03	−0·03	+0·03	+0·09	+0·06
Mean monthly difference between simultaneous Thermograph and Thermometer readings	0·11	0·23	0·16	0·17	0·08	0·10	0·15	0·16	0·15	0·17	0·14	0·15	0·16	0·17
No. of errors in maxima and minima	1	—	2	—	2	—	3	—	5	—	0	—	10	—

* From 9th to 17th the vane did not work properly, owing to paint having got into bearings of the shaft.
‡ Photographic blemish.
† Instrument being shown to visitors.
§ Curve prepared with contaminated distilled water.

The following cheques for May were drawn on the 26th of that month:—

	£ s. d.	£ s. d.
Administration:		
R. H. Scott, salary		66 13 4
Special Researches:		
Negretti & Zambra, atmometer		2 5 0
J. H. Woodstock, cases for sea-temperature thermometers		1 10 0
Office Expenses:		
J. S. Harding, jun.		27 15 6
J. S. Harding, sen. — Salaries and wages		*8 19 8
T. D. Bell		12 4 5
Land Meteorology:		
J. E. Cullum (Valentia), salary		15 0 0
F. Figg, reduction of "Pagoda" observations		8 2 6
Hopkin & Williams, chemicals		3 16 2
R. H. Curtis		18 17 9
J. A. Curtis		15 11 1
T. E. Allen — Discussion, &c. of Observations		15 11 1
C. H. Thompson		*9 4 0
E. G. Aldridge		*7 6 8
Weather Telegraphy:		
Postmaster General, telegrams		184 12 2
F. Gaster		28 15 9
W. L. Dallas		19 15 1
F. Brodie — Preparation, &c. of Weather Reports		17 12 2
H. W. Chivers		*6 12 0
Ocean Meteorology:		
Negretti & Zambra, "A." instruments	34 11 6	
" "B. T." "	20 4 0	
		54 15 6
Hughes & Kimber, copper plate		2 8 9
Captain H. Toynbee		33 6 8
R. Strachan		27 15 6
C. Harding — Reduction, &c. of Observations and care of instruments.		20 0 0
H. Harries		*11 4 0
Miscellaneous:		
Negretti & Zambra, commissions		91 1 0
J. Worley "		2 2 1
J. S. Harding, jun., petty cash		150 0 0
" "		100 0 0
		£962 17 10

* Four weeks ending 24th May.

The Council then adjourned.

116, *Victoria Street, June* 13, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | MR. GALTON.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (June 6) were read and confirmed.

The draft form for the issue of Forecasts was submitted, as directed at last meeting, and was approved.

The Secretary was instructed to commence the regular distribution of Forecasts as soon as the necessary arrangements in the Office should permit.

A printed form of announcement of the terms on which Forecasts are to be supplied, as fixed by Minute of May 22, was submitted and approved.

The Secretary reported that he had applied for and received permission to exhibit the Forecasts at the following places:—

The Mansion House.	Messrs. Beck and Co., Cornhill.
Lloyd's.	Elliott and Co., Strand.
The Corn Exchange.	Negretti and Co., Regent Street.
The Library, House of Lords.	Pastorelli and Co., New Bond Street.
The Library, House of Commons.	Stanford and Co., Charing Cross.
Westminster Hall.	

Submitted the following report on the improvement of the 2 p.m. and 6 p.m. reports:—

(1.) I beg to make the following suggestions for extending and improving the afternoon (2 p.m. and 6 p.m.) Weather Reports. At present we receive by wire:—

For *8 a.m.* reports.—Observations from 52 stations, of which 28 are British, 24 Foreign.

For *2 p.m.* reports.—Observations from 11 stations, of which 9 are British, 2 Foreign.

For *6 p.m.* reports.—Observations from 11 stations, all of which are British.

(2.) It is not proposed to make any change in the stations from which the 8 a.m. reports are compiled, but it is proposed to increase their number:—

For the 2 p.m. report by four stations, all of them British, viz., Sumburgh Head, Ardrossan, Dover, and Jersey.

For the 6 p.m. report by 10 stations, four of them British, viz., Sumburgh Head, York, Dover, and Jersey, and six of them foreign, viz., Christiansund, Skudenaes, the Scaw, Cuxhaven, Paris, and Rochefort.

It is also proposed to improve the 6 p.m. London report by having the readings telegraphed from the observer's house at Brixton every evening instead of taking them from the instruments at the Office, where the thermometric exposure is defective.

The reports then issued will be as follows:—

8 a.m. report consisting of observations from	52	stations	-	-	28 British. 24 Foreign.
2 p.m. „ „ „	15	„	-	-	13 British. 2 Foreign.
6 p.m. „ „ „	21	„	-	-	15 British. 6 Foreign.

The value of the 6 p.m. observations will be greatly enhanced by the addition to the number of stations reporting at 2 p.m.

Instructions have been already transmitted to our own observers to commence sending in the observations referred to, but the Continental telegrams cannot be dealt with at present, as it is not known what modifications in international telegraphy may be introduced as a result of the Telegraphic Congress now sitting.

ROBERT H. SCOTT.

The action already taken was approved, and the Secretary was instructed to endeavour to obtain an increase in the number of the foreign reports as soon as possible, and to

include in them, if feasible, reports from some station at a high level like that on the Puy de Dome.

The revised draft of the Annual Report was considered and finally approved; the Chairman was requested to examine the revise and to send a signed copy to the Royal Society by the 19th instant.

Submitted—The following letter (Minutes, p. 9) :—

M.O. 1336.

Bureau Central de Météorologie,
Paris, le 7 Juin 1879.

MON CHER MONSIEUR SCOTT,

JE VOUS prie de transmettre mes remercîments au Meteorological Council pour la décision qu'il a prise au sujet des observations simultanées de 6h. 35m. T.M. de Paris. Avec les dépêches télégraphiques et les renseignements que vous voudrez bien me donner par les enregistreurs de vos sept observatoires, le réseau sera assez étendu ; je serais très-heureux si la Société Météorologique pourrait aussi y ajouter quelques stations.

Je fais, en ce moment, des démarches pour publier ces observations in extenso dans un bulletin mensuel afin de les mettre à la disposition de tous les météorologistes, mais c'est une question d'argent très-sérieuse, surtout au début d'une organisation compliquée, et je n'ai pas encore pu la résoudre. Cependant je crois que ce serait une chose utile et j'espère en venir à bout. Un proverbe Anglais dit, Time is money ; on peut dire avec autant de vérité, Meteorology is money.

Votre bien dévoué,
E. MASCART.

Monsieur R. Scott.

The Secretary was instructed to supply M. Mascart with special readings from the automatic records as requested by him.

Read—The following letter :—

M.O. 1239.

Foreign Office, May 24, 1879.

SIR,

I AM directed by the Marquis of Salisbury to transmit to you the accompanying copy of a despatch from Her Majesty's High Commissioner in Cyprus containing certain proposals with regard to meteorological observations, &c., and I am to request you to inform his Lordship what reply should be returned thereto.

I am, &c.
(Signed) PHILIP CURRIE.

The Secretary
to the Meteorological Office.

Government House, Nicosia, Cyprus, April 22, 1879.

MY LORD,

I HAVE the honour to request that the Meteorological Office may be asked to supply the Government of Cyprus with books for recording observations, and if they were willing to supply, free of cost, three sets of instruments, I would undertake to supply them annually with the results of observations made in different parts of the Island.

I have, &c.
(Signed) G. J. WOLSELEY.

The Most Noble the Marquis of Salisbury, K.G.,
&c. &c. &c.

Resolved—That the request to supply three sets of instruments be complied with, but that the Secretary inform Mr. Pauncefote that at Larnaca Staff-Commander Bond was already prepared to establish a station, and that the Council presume that only two additional stations will be required.

Read—The following letter :—

M.O. 1374.

Foreign Office, June 11, 1879.

SIR,

I AM directed by the Marquis of Salisbury to transmit to you herewith a programme, which has been received from the German Ambassador at this Court, of an International Fishery Exhibition to be held at Berlin in the year 1880, under the patronage of His Royal Highness the Crown Prince of the German Empire and of Prussia, and I am to request that in laying this paper before the Council of the Meteorological Office you will state that the hope has been expressed on the part of the German Government that similar collections may be contributed to the Exhibition in question as were furnished by the Meteorological Office to the Fishery Exhibition held at Paris in 1875.

I am, &c.
(Signed) JULIAN PAUNCEFOTE.

The Secretary
of the Meteorological Office.

The Secretary was instructed to reply that the Council would be happy to exhibit at Berlin a set of their instruments and of their Storm Signals, Weather Charts, Forecast arrangements, &c.

Submitted—An application from the Coastguard Officer at Belmullet, Co. Mayo, (Letter 1226) for the supply of a fishery barometer to Ballyglass, on Broadhaven Bay.—Granted.

Reported—That the Galton's pantagraph ordered by the Council (Minutes, p. 117) had been sent to the Office.

Reported—That one of the clerks engaged on piece work, Mr. Shave, had died suddenly, leaving his family in great need of assistance.

The Secretary having reported that Mr. Shave, up to the time of his death, had been very diligent in the service of the Office, and very useful to it—Resolved—That one quarter's salary, amounting to 27*l.* 6*s.*, be granted to his widow.

Mr. Ley's revised draft of the "Weather Guide" (Minutes, 1878, p. 122) and his proposed Instructions for Cirrus Observations (Minutes, 1879, p. 2) were distributed to the Council.

The following cheques were drawn :—

	£	*s.*	*d.*
E. J. Strachan, Arctic work - - - -	2	14	0
A. Shave, gratuity - - - - -	27	6	0
R. Mustart, Dutch observations - - -	3	16	11
W. Allingham, observations for General Myer - -	3	5	4

The Council then adjourned.

116, *Victoria Street, June* 20, 1879.

PRESENT :

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | GENERAL STRACHEY.
MR. GALTON. | PROFESSOR STOKES.
THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (June 13) were read and confirmed.

The Secretary reported that the Report for the year 1878–9 had been sent to the Royal Society on 19th instant, as directed at last meeting.

Reported—That the letter to the Foreign Office with reference to the proposed Meteorological Stations in Cyprus had been sent, as directed at last meeting.

Reported—That the forms for the entry of Sea-Surface Temperature Observations had been received from the Stationery Office, and had been issued. (Minutes, p. 15.)

Reported—That the issue of Forecasts for the eleven districts on the form approved by the Council would be commenced on Monday, the 23rd instant, and that the arrangements for telegraphing Forecasts during the hay season were in progress.

Reported further—That Mr. Buchan had forwarded a list of eight persons resident in Scotland to whom Forecasts might be sent during the hay season. (Letter 1402.)

The Secretary was instructed to forward the Forecasts by telegraph to the Office of the Scottish Meteorological Society, provided arrangements could be made for their receipt daily between 5 and 6 p.m., and to request Mr. Buchan to keep a register of the results.

The Secretary was further instructed to obtain additional reports for 2 p.m. from, say, six additional stations during the hay season.

It was resolved that inquiries should be made with the view of obtaining from some competent authority daily telegraphic information as to the weather in Switzerland.

Read—A letter (No. 1468) from M. Mascart (Minutes, June 13), stating that he wished to commence the simultaneous observations at 6h. 53m. (Paris time) on the 1st of July.

The Secretary was instructed to request the observers at the self-recording stations to take daily readings of their curves at that time.

Read—The following letter:—

M. 9070. M.O. 1444.

SIR, Board of Trade, Marine Department, June 18, 1879.

I AM directed by the Board of Trade to transmit the enclosed copy of a letter which they have received from the Colonial Office, relative to the proposed scheme to establish a central observatory in the West Indies, and to state that, before replying to it, the Board will be glad to be favoured with any further observations which the Meteorological Council may desire to offer upon the several points to which it refers.

I am, &c.

The Secretary, Meteorological Office, (Signed) THOMAS GRAY.
116, Victoria Street.

SIR, Downing Street, June 2, 1879.

IN reply to your letter of the 12th instant, I am directed by the Secretary of State for the Colonies to request that you will again bring under the consideration of the Board of Trade the scheme recommended by the Meteorological Council for the establishment of a central observatory in the West Indies.

The special points on which Sir M. E. Hicks-Beach would be glad to be favoured with the opinion of the Board of Trade are, whether the scheme is practicable and likely to effect the objects in view, and, if so, whether the advantages to be derived from it are such as would justify an application to Parliament for funds towards carrying it out, and in that case what should be the amount of the grant to be asked for.

I am, &c.

To the Secretary, Board of Trade. (Signed) ROBERT G. W. HERBERT.

The draft of the "Weather Guide" was taken into consideration, and a letter from Mr. Clement Ley was read containing the following questions:—

Whether the Appendix Table of Reductions to Sea Level is to be inserted, and, if so, whether I am to prepare a MS. copy?

Whether a Table of Reductions to Gravity at Lat. 45° is to be inserted (as I think it had better), and, if so, whether I am to send it in MS.?

Whether I shall attempt a brief preface or introduction for consideration, or leave this for other hands?

The Secretary was instructed to reply:—

(1.) That it is not advisable to print full tables of the nature suggested by Mr. Ley in an appendix to the "Weather Guide," but that instead, "skeleton tables" for the barometer and the wet and dry bulb thermometer, sufficient to give the reader an idea of the magnitude of the corrections and of the mode of applying them, might be inserted in the text, with a reference to publications where the tables in full are to be found.

(2.) That the Council will themselves prepare an advertisement or preface.

With reference to the chart of barometrical pressure, it was resolved to repeat a part of the Chart, so as not to divide the Pacific Ocean.

The Chairman reported that he had presented on behalf of the Council, to the Central Meteorological Office at Rome, the set of instruments exhibited by this Office at the recent International Congress.—Approved.

The Chairman was requested to prepare, in conjunction with the Secretary, a report on the present condition of the work of the Office, and on the best means of strengthening the various departments.

It was resolved that the next two meetings be held on June 30 and July 7 respectively.

The Council then adjourned.

116, *Victoria Street, June* 30, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (June 20) were read and confirmed.

The Secretary reported—(1.) That Mr. Mosse, the Registrar of the Royal Dublin Society, had forwarded a list of six persons resident in Ireland to whom Telegraphic Forecasts might be sent during the present hay season; (2.) That the issue of the Telegraphic Forecasts would commence this evening in the case of those districts where cutting had begun; (3.) That the regular issue of Forecasts by post would commence at the same time; (4.) That he had found it necessary to make arrangements to have the type of the Forecasts set up by a compositor and the matter printed, at least for the present, at a printing office, inasmuch as the small hand-press belonging to the Council (Minutes 1878, p. 145) was not large enough to take the Forecast form.

Authority was given to the Secretary to purchase a press and its appurtenances (whenever he thinks sufficient experience has been acquired), and to employ a printer daily in the Office for the Forecasts.

Submitted—The following memorandum (Minutes p. 31) :—

To the Secretary of the Meteorological Council.

DEAR SIR,

I HAVE the honour to acknowledge the receipt of your letter of the 24th of March, directing me to submit, for the consideration of the Meteorological Council, some definite scheme for telegraphing cirrus observations.

Four practical problems suggest themselves. It will be necessary—

I. To obtain observers.

II. To ensure that the observations shall be reliable, and made with due regularity and diligence.

III. To organise an easily intelligible system of telegraphy.

IV. To utilize the telegrams when received.

Although the terms of your letter seem to refer to the third only of these points, I think that I shall probably not be going beyond the limits of my task if I offer some suggestions upon each of them in the order in which they present themselves.

I. The Meteorological Office already has, as the Council are aware, several observers upon its staff who have had some experience in this particular work, and who are so situated as to be able to communicate information of special value as to the movements of the upper clouds, viz., Messrs. Cullum of Valencia, Thomas of Scilly, and Walker of St. Ann's Head. Of observers unconnected with the Meteorological service a few of the most indefatigable workers are unfortunately situated at so great a distance from a Postal Telegraph Office that they can hardly be expected to send telegrams of the kind required, at least with any regularity. But there are some observers favourably situated, and whose observations would, I believe, prove of practical utility, who would probably, the cost of telegrams and perhaps of messages to the telegraph offices being defrayed, be ready to send the desired intelligence.

In Scotland and Ireland there are a few observers who have worked at this class of observations in connexion with the Scottish Meteorological Society, and whose reports of the movements of upper clouds are sent to Mr. Buchan. Application will, I presume, have to be made to Mr. Buchan if it be thought desirable to obtain the services of these observers.

In England there are a few Fellows of the Meteorological Society who are much experienced in this work, and whose observations are most thoroughly reliable. Some observations of the movements of cirrus are taken at some of the observing stations of the English Meteorological Society.

The material for the construction of a very efficient corps exists, as I believe, in the coastguard on many parts of our shores. The organisation of such a corps will perhaps be no difficult task at a future time, if the public shall then be convinced of the utility of this class of observations.

II. Inexperienced observers undoubtedly find a good deal of difficulty in taking observations of the upper clouds. This difficulty commonly consists in the first place in their finding it hard to distinguish different types of cloud, and to recognise the relative levels of various strata of cloud when seen in the sky at the same time. In estimating the direction and velocity of the movements of clouds as seen in various parts of the sky, these observers meet with a second difficulty,

that of making due allowance for the effects of perspective. I think it will be desirable to send to all the observers, whether experienced or otherwise, who are invited to co-operate, a paper of instructions explaining both the nature of the observations and the mode of telegraphy which shall have been decided upon. And I think it will be well that this paper should contain some prints of those forms of clouds which the observers are particularly to examine, as well as directions on the method of observing them.

I will, in the latter part of this memorandum, submit for consideration a set of instructions as a specimen of the kind of thing which I think may usefully be issued to the observers.

I have ventured in this specimen of instructions to refer to a very simple cloud reflector which I have devised for cirrus observations, in the hope, not that this particular instrument (which is susceptible I think of great improvement), may come into use, but that some form of reflector for measuring the apparent velocity as well as direction of cirrus may eventually be employed to the comfort of a considerable class of observers.

I have likewise described a very rough and inexpensive contrivance which may be useful to the observer who is not possessed of a suitable reflector.

The amount of cirrus apparent on the sky is an element of some importance, though in some cases rather difficult to estimate. The scale which I have suggested in the instructions, corresponding with the old weather scale, will I think be found convenient.

Next to the amount should follow in every report the direction (true) from which the cirrus clouds move, when such direction can be ascertained.

Some scale of apparent velocity of movement is much needed. I may mention that I have on some occasions obtained from observations of the velocity of cirrus valuable indications of the intensity of distant storms. This has especially been the case when extremely rapid W. or N.W. upper currents have been observed to move over sluggish or moderate southerly surface-winds; *e.g.*, the most rapid north-westerly upper current which I think I ever noticed I observed in Herefordshire on the morning of January 24, 1868, the day of the great southerly hurricane in Scotland. Unfortunately observers, so far as my experience has gone, differ very greatly in their estimation of this element. The scale which I have proposed will, I think, under present circumstances be more useful than one of greater extent. And perhaps if the observers will employ some method, similar to that which I have suggested, of testing their own estimation of velocity according to the scale, greater uniformity may be secured. Such a method possesses also this advantage, that from its use, if the altitude of the cirrus be approximately known, the actual rate of movement can be roughly ascertained, and thus in possible future investigations the data now reported may have a value which would not otherwise belong to them.

I think that the direction in azimuth of the bands of cirrus, or the "warp" or "selvedge-way" of a sheet of cirro-stratus is very nearly as important an element as the direction from which the clouds are observed to move. It gives us, roughly, the contour of the isobars for the level of the cirrus, and is thus found to afford us some means of judging of the position of the centres of high and low pressure when these are at a considerable distance from the station of observation. A minor consideration in favour of its being telegraphically reported is this, that it affords us the means of checking, to some extent, the telegraphic reports of the movements of the cirrus, and also of conjecturing these movements when the observer is unable to report them. The direction of the band (*i.e.* "r.-point" as presently explained in the Instructions) may not unfrequently be observed at moments when the actual movements of the clouds cannot be noted; and this direction is usually within a few points of the direction of movement. When it is otherwise reported, it may be well, should it be possible to do so, to have the telegram repeated, in order that accuracy may be insured. In connexion with this, I may mention that I do not think it desirable to call the attention of *observers* to the prevalent relation between the direction of movement and the direction of position. Important exceptions occur in this relation on days in which the upper currents observed at the different stations vary much.

The manner in which the direction of "warp" of cirrus should be reported is open to question As regards the term itself, or the expression "radiation" which I have employed in my own observation forms, (or indeed any word which I have yet seen employed to designate this idea,) I must own that it is liable to objection. But I have not for the most part found observers to be slow in apprehending what the thing is which we intend to denote. Some of the most careful observers, such as Colonel Ward of Rossinière and Mr. Glyde of Torquay, send reports of the direction of the smaller filaments of cirrus, "cross-radiation" as some of them term it, or the "woof" of reticulated cirrus; but it may be necessary to caution such observers, should the Council be fortunate enough to secure their services, against over minuteness in their telegraphic reports. The fault is commonly the other way.

The direction of what I have termed the warp of cirrus *is in most cases* at right angles or nearly so to the position of a *bank* of cirrus or cirro-stratus, when the latter is seen near the horizon. But we do not, from our knowledge of the former element, know on *which* horizon a cirrus bank has been visible to the observer. I think that the position of cirrus banks is a highly important element in forecasting the weather, and must therefore be telegraphed when such banks are or have been observed. It likewise gives us some means of checking the reports of the "warp" or "radiation," similar to that which the latter gives us in regard to the reported direction of movement.

III. I do not know whether the telegraphic arrangements of the Meteorological Office make it necessary that the reports be sent in figures only. If not, it will, in my opinion, be much best that the observations be telegraphed in *letters*, since by this means the elements already described as of

importance can all be telegraphed in one five-letter word, according either to the very simple plan which I will presently suggest, or to some scheme analogous to it.

If the system be accepted, I would submit that it will be desirable that its adoption, not only by the official but by all the non-official observers, be compulsory, that is to say, that such non-official observers as may be disposed to assist the Office by transmitting these telegrams be requested to undertake to send the *first word* of their telegram *in all cases* in accordance with this notation, being permitted to add thereto such other words as they may think necessary or fit.

Among these other words, however, it will be desirable that there should follow next a mention of the hour at which the observations were undertaken, *unless* these observations were taken *within one hour* previous to the time of telegraphing. Then the observer may add remarks on the form of cirrus observed, *e.g.* "feathery," "thin," "very lofty," "cir.-cum.," "cir.-s."; followed, if the limits of the telegram admit of it, with some remarks as to the lower forms of cloud in the sky. I have not thought it needful to suggest the easily-devised code by which such observations can, if it be thought desirable, be condensed, but shall be happy to do so if required.

It will be seen that I do not recommend that (*in the five-letter word*) any distinction be attempted between the different *kinds* of cirrus. These kinds so shade off into each other that, in the present condition of cloud-classification observers would be embarrassed by being obliged to decide to what division of cirri-form clouds any variety may belong; while, if they are left free, where the limits of the telegram admit, to add remarks of their own, they will in some cases contribute what may hereafter prove useful data for investigation on the distribution of the forms of clouds.

My object has been to provide a method by which the official observers may, when occasion offers, by the addition of *one word* to their regular telegrams, provide the most important of this kind of materials for use in weather forecasting, and at the same time to secure uniformity and to avoid the accumulation of unnecessary matter in the *occasional* telegrams, and in the telegrams of the non-official observers.

The most diligent observer does not obtain opportunities of observing cirrus on more than 18 or 19 days in a month on the average: but in stormy periods opportunities occur almost daily; the times when cirrus observations are scanty being commonly those of dull, tranquil weather in winter, or very dry fine weather in summer, times in which forecasting is comparatively both easy and unimportant.

I may add that a code of telegraphing in *figures* can (if desired) be immediately substituted for that which I propose, but it would, in my opinion, be less convenient.

IV. As regards the employment of the information thus obtained, I suppose that I am not called upon to say much at present. The experience of the Office will, I feel sure, soon indicate the directions in which the system should be developed. If I may be permitted to refer to my own lecture on "Clouds and Weather Signs," now in the press, I would say that the *kind* of rules which I have there given may perhaps prove useful in this part of the work. And I need not add that if I can ever in any way give any assistance to the Meteorological Council in this matter, my services will be at their disposal.

Instructions on Making and Telegraphing Observations of the Upper Clouds.

The attention of the observer is especially to be directed to clouds of the "cirrus" types, inclusive of true cirro-stratus and cirro-cumulus; and it is to these types of clouds that the following code of instructions alone refers.

Cirrus (cir.) is the highest kind of cloud. When in moderate quantities it is commonly white, though when seen through haze it is usually somewhat cream coloured, and when the sun's rays have reached it through a long stratum of hazy atmosphere, it is often of either an orange or rosy tint. In all cases it has a very delicate appearance. It is sometimes arranged like bunches of fine hair; and such tufts of cirrus are often called "mare's-tails." At other times it resembles small curled feathers. Quite as commonly, however, it lies in thin light strands, like pale gossamer threads.

"Cirro-cumulus" (cir.-cum.) differs from simple cirrus in being more rounded in form, consisting of small detached masses, a great flotilla of which is often seen in the sky, especially in fine summer weather. Clouds at lower levels are frequently disposed in this manner, and the observer must be very careful to distinguish from these the true cir.-cum., which latter always is either white, or changes its colour under the same circumstances as simple cir., no part of each cloudlet ever seeming to be decidedly *thrown into shadow* by another part. The true cir.-cum. also possesses the same faintness and delicacy of outline which we observe in cir.

When cir. overspreads a large portion of the sky it becomes "cirro-stratus," (cir.-s.) or "sheet-cirrus." In this state, when not too thick, it produces "halos" or large rings round the sun and moon. The sheet cirrus sometimes appears fibrous, sometimes reticulated; sometimes, however, it is only visible as either a milky or an oily-looking haze.

When the veil of this cloud becomes thick it assumes some neutral or muddy tint, except in those cases when it is so disposed that the rays of the rising or setting sun are reflected to us from its under surface, which then appears of either an orange or rosy colour.

Some of the commonest appearances of these three varieties are shown in the accompanying sketches. There is, however, no precise line of demarcation between the varieties, and it should be the principal endeavour of the observer to distinguish them, not so much from each other, as from the clouds which float at lower levels.

I.

Amount.—Whenever on looking round the sky the observer notices any clouds of the kinds above described, he should in the first place endeavour to ascertain their *amount*. In doing this he should

observe whether they cover, first, a trifling portion; secondly, about half; thirdly, about three-fourths; or finally the whole of the sky. The *extent*, not the density of the cloud, should be here attended to. If there is any considerable quantity of lower cloud in the sky, the amount of upper cloud cannot be ascertained.

II.

Direction of Movement.—The next thing to be attended to is the direction from which the upper clouds move, or the direction of the current in the higher regions of the atmosphere. Considerable difficulty will here be encountered. If some of these clouds happen to be nearly overhead, attention should at first be confined to such; and if possible the observer should so place himself as to have the projecting corner of a roof or chimney, the summit of a steeple, flag-staff, or other stationary object very close to the line between his eye and the portion of cloud which he is about to watch.

If not possessed of a suitable mirror, a convenient plan is to set up a pole reaching 5 feet $7\frac{1}{2}$ inches above the level of the observer's eye, cutting a mark or setting a ring round the pole at the latter level. The summit of the pole must carry two thin rods, fixed crosswise, and set truly by compass to the four cardinal points. Through or near the extremities of these rods should pass a thin circular iron ring of 3 feet diameter, the use of which will be mentioned presently. The observer should, when opportunity offers, so station himself that some recognizable part of a cloud appears to move vertically either upwards from the top of the pole, or vertically downwards towards it. The direction of the pole from the observer's position, which may be judged of by the cross-rods, is then, in the first case, the direction of the upper current, in the second, its opposite.

Much trouble, as well as the discomfort arising from having to direct the eye towards a bright sky, and other difficulties, may be avoided by the use of the simple inclined mirror contrived for the purpose.

In observing the clouds from a window it is some assistance to have a few wires,—some horizontal, some vertical,—fastened across the window to the wall on the outside.

When, however, no part of the cloud is moving directly either towards or away from the observer, the effects of perspective render it difficult to estimate the direction of movement exactly. To perfect oneself in the art, it is advisable as often as possible to endeavour to estimate the direction of movement of some portion of the cloud which is inconveniently placed, and then to find the actual direction of movement of another portion of the same cloud, or same sort of cloud which happens at the time to be conveniently placed. By patiently practising the eye in this process the observer eventually learns to make, automatically, tolerably exact allowance for the errors arising from perspective. In no case (should he have the least doubt as to the direction of movement) must any conjecture be telegraphed.

It is always well, when observing the movements of the upper clouds without the mirror, to rest the head against a wall or tree, or to support it by the arm, or by some other means, so as to be quite motionless while taking an observation.

III.

Apparent Velocity.—The next particular to be attended to is the *apparent velocity of movement* of the clouds, or the force of the current which carries them. The observer is requested to notice whether the cloud be actually stationary, move slowly, with moderate rapidity, or lastly, with unusual rapidity. Clouds of the cirrus types are seldom really motionless, but owing to their great distance they commonly, though not always, appear to move more slowly than the lower clouds. To estimate, even according to the very rough scale proposed, the apparent velocity of movement, we have to encounter precisely the same difficulties which have presented themselves in finding the direction, and the training of the eye requisite for deciding this is identical. A cloud which is near the horizon of course presents much less movement to the eye than one which is near the zenith, because it is at a much greater distance; and, further, the apparent movement of clouds which are travelling either across, or more or less obliquely to, the line of sight, is different from that of clouds which are travelling directly to or from the zenith. To test the accuracy of his estimation of the apparent velocity of clouds moving crossways and obliquely, the observer should, when occasion offers, compare it with his estimation of the apparent velocity of clouds in the same stratum passing overhead at the time. To test the accuracy of his latter estimation he will do well occasionally to notice how many seconds of time a recognisable portion of upper cloud takes in travelling 15 degrees on the sky to or from the zenith. A theodolite may be employed for this purpose, or the mirror may be used, or finally the pole arrangement already described can be employed. In this last case a recognisable portion of cloud must be first caught in the zenith, the observer looking up the pole, applying his eye as closely as he can to the ring above mentioned. He should then note the time. It is not necessary that he should continue to watch the cloud throughout its transit of 15 degrees, if he can retain a distinct mental image of the portion of cloud selected, for cirrus clouds rarely alter rapidly in form; but he must return to his position at intervals of a few or many seconds (according as the clouds seem travelling fast or slowly), and eventually have the eye close to the ring as before at the moment when the selected portion of cloud, as viewed from this spot, reaches the circular wire. The time taken by the clouds in passing over this distance from the zenith, which is (approximately) 15 degrees, should be then noted. When clouds of the cirrus types take a longer time than 600 seconds in traversing 15 degrees to or from the zenith, their motion should be regarded as "very slow." When a less time than this, but a longer time than 300 seconds, as "moderate," and lastly, whenever they take a less time than 60 seconds as very "rapid."

It may be mentioned that in simply looking at the sky without the aid of any appliance, such as the mirror, the pole, or a plummet hung from a wire above the head, inexperienced observers commonly estimate the position of the zenith wrongly because they do not throw the head far enough back.

IV.

"*R.-point.*"—Clouds of the cirrus kind very commonly lie in streaks, lines, or bands. Attention must next be given to the direction of these lines, *i.e.*, their *position* with respect to the points of the compass altogether *irrespective of the motion of the clouds.* When one of these bands happens to pass through the zenith, the point at which it reaches, or, if continued, would reach, the horizon, is to be noted. This point we call for convenience sake, the *r.-point*, or "point of radiation," because the cirrus bands while really parallel, appear in perspective to radiate from this point, or rather from one beyond it, and beneath the horizon. It is, however, comparatively seldom that a cirrus band happens to lie immediately over the observer's head; these bands usually appearing in perspective as arches, or portions of arches, lying in any part of the sky, and variously inclined to the horizon, according to their distance from the observer. It is easy in these cases to find the r.-point, if we imagine ourselves able to travel over the earth's surface so as to get one of these bands actually seen in the distance over our heads. The best plan, however, is to note, first, the point on the horizon which lies beneath the summit of any visible complete arch of cirrus. If there be no complete arch, but only a short thread visible, the observer should extend his arm so as to point with the forefinger towards this thread, and then pass the arm briskly two or three times backwards and forwards from one part of the horizon to another, continuing as closely as he can the curve of the cirrus thread. The point on the horizon which is immediately beneath the highest part of the curve so formed should then be noted. In every case the r.-point will be a point at right angles to this point on the horizon.

It is obvious that there must always be two r.-points opposite to each other. Although it is in itself immaterial which of these the observer fixes upon, he is requested as a matter of convenience, when he has already found a point from which the upper clouds *move*, to report the r.-point which is nearest to that direction, if one of the two be nearer than the other. For example, if cir. travels from W.N.W. and lies in strands which are disposed lengthwise N.W. and S.E., the r.-point N.W. should be reported in preference to the r.-point S.E.

The "selvedge" of a sheet of cir.-s. gives the r.-point in the same way as a streak of detached cir. And when cir.-s. completely covers the sky, a warp may frequently be seen in it which supplies the same datum.

Small cross rays or tangled threads may very often be noticed, frequently transverse or nearly so to the cirrus bands. These are especially discernible in some varieties of cir.-s., when they form what we may call the "woof" of the cloud sheet, and give to the latter the reticulated appearance already mentioned. No notice of these threads is required in the telegrams. In rather common cases, however, the cross threads are so marked that it is impossible to decide whether a particular point of the compass, or one at about right angles to it, is rightly to be regarded as the r.-point. In such instances the observer should telegraph "uncertain," according to the code.

V.

Lastly, whenever a bank of cir.-s. appears on any horizon, or whenever being overhead, or nearly so, such a bank appears thicker in one part of the sky than in the other parts, the observer is to report the position of bank, *i.e.*, the direction in which the bank lies or in which it is thickest. This direction will not *necessarily* be at right angles to the r.-point, though it most commonly is so.

Mode of Telegraphing the Observations.

Observers are requested to communicate the class of observations above described to the Meteorological Office by telegraph, according to the following code:—

The observations to be telegraphed in one symbolic word, which is always to be of five letters.

The first letter always to be a vowel, the second a consonant, the third a vowel, the fourth and fifth consonants, except that the letter O stands always for a cipher, the letter Y for uncertainty in the mind of the observer; and the letter Z for absence of motion in the cloud observed, as presently to be explained.

I. The first letter in the five letter word always to represent *amount* of cirrus, according to the following scale:—

O = trifling cirrus. (Sky nearly devoid of it.*)
A = a quarter clouded with cirrus.
E = half clouded.
I = three-quarters clouded.
U = entirely covered.
Y = uncertain.

II. The second letter to give *direction* from which the cloud moves, according to the following notation in which all the consonants, with the exception of N, W, X, are employed. O to be

* O has thus a slightly different meaning as the first letter than as any other. (Of course it will be understood that if *no* cir. at all is visible, no cirrus telegram is to be sent.) In any other place in the five-letter word O simply denotes the absence of the element which would, in that place, be reported.

inserted here when no observation of movement has been made, and Y when uncertainty is to be ndicated:—

North (true)	B
N.N.E.	C
N.E.	D
E.N.E.	F
E.	G
E.S.E.	H
S.E.	J
S.S.E.	K
S.	L
S.S.W.	M
S.W.	P
W.S.W.	Q
W.	R
W.N.W.	S
N.W.	T
N.N.W.	V
Motionless	Z

III. The *third* letter to be always one of the first three vowels (except where O, Y, or Z have to be inserted here in the telegram) and to signify apparent *velocity* of movement, according to the following scale:

Z = Absence of motion.*
A = Very slow.
E = Moderately rapid.
I = Intensely rapid.
O = Absence of observation.
Y = Uncertainty in mind of observer.

IV. The fourth letter to be always a consonant (except where O or Y occurs in this place), and to signify r.-point, or posture of cirrus band, as explained in these Instructions. Notation to be according to the consonant scale given above (same as for second letter). O to signify here absence of any discernible parallelism in the cirrus threads; Y uncertainty in mind of observer.

V. The fifth letter to be always a consonant (except where O or Y occurs here), and to indicate on what horizon a cirrus or cirro-stratus bank is lying; or if the bank be overhead, in which quarter it is thickest. Notation according to the consonant scale above given, O to signify here absence of cirrus bank, Y uncertainty of observer.

The following specimen of the mode in which the observations of cirrus should be telegraphed will illustrate the employment of the scheme recommended:—

I. "About a quarter of the sky covered with cirrus travelling from N.W. with moderate rapidity, lying in lines from N.N.W. to S.S.E. thick on west horizon," should be telegraphed thus "ATEVR."

II. "Very little cirrus, moving from N., very slowly, lying in strands from N. to S., no bank of cirrus visible," should be telegraphed "OBABO."

III. "Sky half covered with cirrus, travelling from S.S.W., with extreme rapidity, stretching from S. to N., thick in the east," should be telegraphed "EMILG."

IV. "Sky totally covered with cirro-stratus, moving from West, very slowly, not in perceptible bands, the observer unable to say in which direction the bank is thickest," should be telegraphed "URAOY."

The first word of the telegram, or of that portion of the telegram which comprises the cloud observations is always to be sent in accordance with this notation. The observer may add according to his discretion and his space any remarks on the form of cirrus observed, *e.g.*, "feathery," "thin," "very lofty," "cir.-cum.," "cir.-s.," "cir.-haze," followed, when desirable, with any remarks as to the lower forms of cloud in the sky, as to their movement, as to the occurrence of halos, mock-suns, &c. But before adding these remarks, and immediately after the symbolic word, the observer should mention at what hour the observations were taken, unless the observations are taken only at fixed hours, or unless they were taken within one hour previous to the time of telegraphing.

I remain, &c.

May 16, 1879. W. CLEMENT LEY.

Resolved—That Mr. Gaster communicate with Mr. Ley on the subject of "Cirrus cloud" observations, and report to the Secretary for the Council.

The Chairman submitted a report (Letter 1642), (as requested at last meeting) on the present condition of the work of the Office, which was considered; and it was resolved:—

I. That an additional clerk be engaged in the Pantagraph Room, at a salary not exceeding 25*s.* a week for eight hours work.

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* When Z occurs once in the cirrus telegram, it will, if the code be adhered to, always occur twice. Really motionless cirrus is a somewhat rare phenomenon. Unless satisfied that the cloud is *absolutely* stationary, the observer should insert Y.

II. That a clerk be engaged to attend to the telegraphic instruments for nine hours daily, at a salary, not exceeding 30*s.* per week, as soon as possible.

III. The Hydrographer was requested to make inquiries and to suggest the name of a gentleman suitable to be employed as an assistant in the Marine Department.

IV. The Chairman and Secretary were authorised to treat for accommodation on the ground floor of 116, Victoria Street.

General Strachey was requested to act with the Chairman as auditor of the accounts for the current year.

Reported.—That the following cheques for June were drawn on the 26th instant:—

	£ s. d.	£ s. d.
Administration:		
R. H. Scott, salary	-	66 13 4
Special Researches:		
Negretti & Zambra, repairing anemometer, &c.	-	10 0 0
Office Expenses:		
J. S. Harding, jun. } Salaries and wages	27 15 6	
J. S. Harding, sen. }	*11 4 7	
T. D. Bell }	12 4 5	
		51 4 6
C. W. Jacques, rent	-	133 13 0
Williams & Norgate, books	-	5 0 2
Land Meteorology (Quarterly Allowances, &c.):		
D. Thomson, Aberdeen	-	68 2 6
T. R. Robinson, Armagh	46 19 0	
,, (expenses)	10 18 8	
		57 17 8
W. L. Fox, Falmouth	-	72 10 0
R. Grant, Glasgow	-	68 2 6
H. Williams, Holyhead	-	2 13 5
G. M. Whipple, Kew	-	100 0 0
C. Clouston, Orkney	-	3 3 10
G. H. Aird, Seaham	-	2 13 9
S. J. Perry, Stonyhurst	-	55 4 0
J. E. Cullum, Valencia	15 0 0	
,, (expenses)	44 17 8	
		59 17 8
G. T. Watson, Yarmouth	-	3 19 6
Bates, Gildea, & Walker, photo.-dishes	-	1 11 3
R. & J. Beck, pantagraph	80 0 0	
,, repairs, &c.	1 0 8	
		81 0 8
Hopkin & Williams, chemicals	-	0 11 8
W. Marriott, Meteorological Society's Returns	-	25 0 0
J. O'Driscoll, rent, Valencia	-	25 0 6
R. H. Curtis } Discussion, &c. of Observations	18 17 9	
J. A. Curtis }	15 11 1	
T. E. Allen }	15 11 1	
C. H. Thompson }	*11 10 0	
E. G. Aldridge }	*9 3 4	
		70 13 3
For Telegraphy (Quarterly Allowances, &c.):		
H.M. Postmaster General, telegrams	-	152 3 0
Postmaster, Ardrossan	0 6 6	
W. McNeil, ,,	0 13 10	
		1 0 4
Postmaster, Bundoran	-	0 13 0
H. Todd, Cambridge	-	4 11 3
Postmaster, Cliffony	-	0 13 0
Carried forward	-	£1,123 13 9

* Five weeks to the 28th instant.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	1,123	13	9
J. MacGowan, Donaghadee - - -	-		-	0	13	0
J. Costello, Dover - - - -	-		-	3	5	6
W. Brand, Dunrossness - - -	-		-	2	5	9
Postmaster, Enniskillen - - - -	-		-	0	13	0
J. Tilston, Holyhead - - - -	-		-	3	18	0
T. Lanceley, Hurst Castle - - -	-		-	3	18	0
A. P. Hay, Inverness - - - -	-		-	1	6	0
J. Fisher, Jersey - - - -	-		-	3	15	0
T. Curtayne, Killarney - - -	-		-	0	13	0
G. Mitchell, Kingstown - - -	-		-	3	18	6
P. Turnbull, Leith - - - -	-		-	0	13	0
F. Gaster, London - - - -	-		-	3	7	6
W. D. Penny, Nairn - - - -	-		-	4	9	2
M. Mackintosh, Nairn - - -	-		-	0	13	0
J. W. Irvine, N. Shields - - -	-		-	0	10	0
E. J. Lowe, Notts - - - -	-		-	3	18	0
C. A. Jenkins, Oxford - - -	-		-	3	11	6
G. Blackler, Prawle Point - - -	-		-	3	5	0
J. C. Walker, St. Ann's Head - - -	-		-	0	13	0
W. Thomas, Scilly - - - -	-		-	5	0	5
R. W. Scaddard, Scilly - - -	-		-	0	13	0
J. Sutherland, Stornoway - - -	-		-	3	19	6
J. Sinclair, Wick - - - -	-		-	3	5	0
J. Murray ,, - - - -	-		-	0	13	0
G. T. Watson, Yarmouth - - -	-		-	4	7	10
Yorkshire Philosophical Society - -	-		-	3	5	0
Patent Type Founding Company, types -	-		-	4	9	2
A Buchan, salary - - - -	37	10	0			
,, expenses - - - -	0	7	0			
				37	17	0
W. C. Ley, salary - - - -	-		-	37	10	0
F. Gaster -	28	15	9			
W. L. Dallas - Preparation, &c. of Weather	20	12	1			
F. Brodie - Reports.	19	2	2			
H. W. Chivers	*8	5	0			
				76	15	0
For Ocean Meteorology :						
P. Adie, repairing "A." instruments - -	2	2	6			
,, ,, "B.T." ,, - -	2	8	0			
				4	10	6
R. Rivière, labels for charts - - -	-		-	1	4	0
Capt. H. Toynbee	33	6	8			
R. Strachan - Reduction, &c. of observations	27	15	6			
C. Harding - and care of instruments.	20	0	0			
H. Harries -	*14	0	0			
				95	2	2
Miscellaneous :						
P. Adie, Commissions - - - -	-		-	3	14	0
Pickford & Co. carriage of parcels (researches acct.)	5	12	7			
,, ,, (incidental acct.)	1	9	10			
				7	2	5
J. S. Harding, jun., petty cash - -	-		-	150	0	0
,, ,, - - - -	-		-	100	0	0
				£1,708	7	8

The meetings of the Council for July were provisionally fixed for the 7th, 11th, and 14th at 11 a.m.

The Council then adjourned.

* Five weeks to the 28th instant.

116, *Victoria Street, July* 7, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (June 30) were read and confirmed.

Reported—That on the 3rd instant a letter (No. 1,613) had been received from Sir John Cowell, asking for a statement of the rainfall of the present summer as compared with that of previous wet seasons, for the information of the Queen, and that on the 4th instant the following tables had been forwarded:—

1. Statements of the amount of rainfall in the eleven districts as in the Weekly Weather Report for the last six months, with the respective differences from the averages.
2. Table of the Monthly Rainfall of London for the last 66 years.
3. Mr. Dines' diagram of London rainfall from 1813–1872. (Quarterly Weather Report, 1873.)
4. Statement of the amount of rainfall in the United Kingdom, for the years 1867–78 inclusive, from Symons' British Rainfall.

On the 7th instant a letter (No. 1,634) was received from Sir John Cowell, conveying Her Majesty's thanks for the information supplied by the Council.

Resolved.—That the statistics transmitted for the information of the Queen be prepared for publication, in a form to be approved by the Chairman and General Strachey.

Read—The following draft reply to the Board of Trade (Minutes, p. 32), which was approved:—

SIR, Meteorological Office, London, July 7, 1879.

IN reply to your letter of June 18, enclosing a letter from the Colonial Office dated June 2, I am instructed to inform you that the Council of the Meteorological Office entertain no doubt as to the practicability of the scheme recommended by them for the establishment of a central observatory in the West Indies.

They believe that the scheme would effect the object in view, and that it might prove of great advantage to the West Indian Colonies, subject always to its receiving a sufficient amount of local co-operation.

While considering that the object is important enough to call for an expenditure of public money, the Council did not originally contemplate that any application should be made to Parliament for a grant towards carrying it out. They regarded the proposal as one of special local interest to the West Indian Colonies, and they thought it reasonable that those Colonies should be asked themselves to provide the necessary funds.

The Council feel that it would be beyond their province to express a definite opinion upon a purely administrative question, but they would suggest that in the first instance the plan should be brought under the notice of the Governors of the West Indian Colonies, with the view of ascertaining to what extent they would be prepared to co-operate in the establishment of a central observatory for the purposes specified.

I am instructed to add that the Council feel the more confidence in the scheme, because in framing it they had the advantage of the assistance and advice of Sir J. H Lefroy (then a member of the Council), to whose opinion they attach great weight, owing to his intimate acquaintance with the special circumstances of the West Indian Islands, as well as with the general administrative and scientific questions involved.

Thomas Gray, Esq.,
Assistant Secretary, Marine Department, Board of Trade.

The Secretary reported that General Myer was in London, and it was resolved that he be invited to meet the Council on Friday.

It was resolved that between the present time and the 1st December next a brief daily account of the latest information as to the weather in the several countries of Europe be communicated to the daily papers.

The draft of the Weather Guide was again considered (Minutes, p. 32), and certain alterations in the text were suggested, upon which the Chairman was requested to report.

SUBMITTED—The following STATEMENT respecting the RECORDS for April 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
Action - - - - - -	Good.	Good.	Good.	Fair.	Good.	Good.	Good.	Good.	Good.	Good.	Fair.	Good.	Indifferent.	Good.
Records deficient, due to stoppage of clock -	0	0	24 hrs.	24 hrs.	9 hrs.	10 hrs.	0	0	0	0	0	0	0	0
„ „ other causes -	0	0	0	0	0	0	0	0	0	0	0	0	†1 hr.	0
Orientation verified - - - - -	25th	—	29th	—	14th	—	5th	—	2nd	—	26th	—	2nd	—
No. of errors discovered by subsidiaries -	0	0	0	0	0	0	1	0	0	0	*24	0	1	2
„ „ irregular differences	0	0	0	0	1	0	0	1	0	0	0	3	0	6
Result of 40 *Remeasurements*:—														
Greatest difference - - - - -	1·0	1·0	0·0	1·0	1·0	2·0	0·0	1·0	0·0	1·0	0·0	2·0	0·0	2·0
Mean difference irrespective of sign - -	0·0	0·5	0·0	0·3	0·1	0·4	0·0	0·4	0·0	0·2	0·0	0·4	0·0	0·7
Residual difference (— Meteorological Office) -	0·0	0·0	0·0	0·0	0·0	+0·1	0·0	−0·1	0·0	0·0	0·0	0·0	0·0	−0·1
RAIN GAUGE:—														
Action - - - - - -	Indifferent.		Fair.		Indifferent.		Fair.		Fair.		Good.		Fair.	
Records deficient, due to stoppage of clock -	0		0		0		0		0		0		0	
„ „ other causes - -	0		0		0		0		0		0		0	
Errors in tabulation - - - -	0		3		2		0		0		0		1	

BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Bad.	Do.	Do.	Do.	Do.
Records deficient, due to stoppage of clock	0	1 hr.	0	0	0	0	0
„ „ failure of light	0	0	1 hr.	0	1 hr.	0	0
„ „ other causes	0	0	0	0	0	‡1 hr.	0
No. of errors discovered—							
In entry of standard	0	0	2	0	2	0	0
„ calculating residual correction	0	2	2	0	0	0	2
„ applying residual correction	1	2	0	0	2	0	7
„ subtraction in subsidiary tables	0	1	0	0	5	0	2
„ tabulation by subsidiaries	0	1	0	0	0	0	0
„ „ irregular differences	0	2	1	3	0	0	1
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·006	0·010	0·012	0·007	0·005	0·015
Mean difference irrespective of sign	0·0014	0·0019	0·0033	0·0027	0·0024	0·0024	0·0024
Residual difference (—Meteorological Office)	+0·0006	−0·0005	+0·0016	0·0000	+0·0005	+0·0011	+0·0007
Mean monthly difference between simultaneous barograph and barometer readings	0·0017	0·0021	0·0019	0·0022	0·0026	0·0014	0·0015

THERMOGRAPH :—														
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Fair.		Do.		Do.		Do.		Do.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	0	2 hrs.
„ „ imperfectly moistened bulbs	—	0	—	1 hr.	—	0	—	1 hr.	—	6 hrs.	—	16 hrs.	—	0
„ „ partially frozen bulbs	—	5 hrs.	—	3 hrs.	—	0	—	10 hrs.	—	4 hrs.	—	8 hrs.	—	0
„ „ other causes	§10 hrs.	§1 hr.	0	0	0	0	0	0	‖1 hr.	0	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	2	0	0	0	0	0	1	0	0	0	0
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	3	1	0	0	1	0
„ „ of subtraction in do. tables	0	0	2	0	0	1	2	0	7	1	0	1	3	2
„ „ detected under glass scale	2	0	4	0	5	1	1	4	9	0	2	4	3	6
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·2	0·2	0·2	0·4	0·3	0·2	0·3	0·3	0·3	0·2	0·3	0·3	0·3
Mean difference irrespective of sign	0·11	0·09	0·08	0·10	0·11	0·09	0·09	0·13	0·14	0·12	0·07	0·15	0·13	0·13
Residual difference (—Meteorological Office)	−0·09	+0·01	−0·07	+0·04	−0·01	+0·02	−0·02	−0·11	−0·03	+0·09	−0·01	+0·12	+0·06	−0·10
Mean monthly difference between simultaneous thermograph and thermometer readings	0·14	0·22	0·16	0·19	0·08	0·11	0·18	0·16	0·16	0·16	0·13	0·14	0·17	0·20
No. of errors in maxima and minima	1	—	0	—	2	—	4	—	4	—	1	—	6	—

* The values for one day omitted from tabulation sheet. † Pencil failed to mark legibly. ‡ Instrument under repair. § Owing to bad action of light stop. ‖ Trace destroyed by an "*air-bubble*."

The question of thermometric exposure was taken into consideration (Minutes 1878, p. 145; 1879, p. 2). The Secretary reported that the temporary arrangement for sheltering M. Wild's thermometer screen had been erected at a cost of 8*l.*, and he submitted a letter (No. 1,631) from Mr. Whipple, stating the nature of the experiments undertaken at Kew with the Stevenson's screen, the Wild's screen, and the De La Rue's screen. He was instructed to ask M. Mascart what is the nature of the experiments undertaken with the captive balloon in Paris.

The subject of Hygrometry was next taken into consideration.

Resolved—That a comparative series of experiments be made, to test the indications of Dines' Hygrometer by the chemical method of determining the absolute amount of water present in the air, and that, in connexion with this subject, comparisons be also made with the wet and dry bulb thermometers, with Regnault's hygrometer, and de Saussure's hair hygrometer.

The Chairman and Professor Stokes were instructed to arrange for having such a series of experiments carried out.

The question of signalling anemometers (Minutes, p. 24) was considered.

The Chairman reported that he had inspected the situation of the instrument on the top of Queen Anne's Mansions, on the 4th instant, in company with the Secretary and Mr. Munro, and that the instrument as erected by Messrs. Negretti and Zambra was badly situated, and, owing to its requiring constant oiling, was unsuitable for use. A letter (No. 1,646) from Mr. Munro was submitted, stating that he could set the instrument in proper order.

Resolved—That Mr. A. Hankey be requested to give permission to the Office to use his large anemometer at present on the Mansions, the Council undertaking to put it in complete repair and to connect it with the registering and signalling apparatus.

Submitted—The following memorandum:—

ADDITIONAL MEMORANDUM on HARMONIC REDUCTIONS, by PROFESSOR STOKES.

In the "Reduction of Greenwich Meteorological Observations" there is no table of mean hourly temperatures given in which the months are combined but the years kept distinct, though the materials for forming such a table are published, as the hourly means are given for the separate years and months.

Sir George Airy has subsequently had these means taken, and has been so kind as to furnish me with a copy of the results. I have now subjected these to harmonic reduction, proceeding as far as the fourth order. The first term, giving the mean, was not calculated, as it is given in the last column but one of Table LII., on page 39 of the Greenwich Reductions. The values of the eight remaining coefficients in the series,—

$$A_0 + A_1 \cos T + B_1 \sin T + \cdots + A_4 \cos 4T + B_4 \sin 4T,$$

are given in the following table:—

COEFFICIENTS in the HARMONIC REDUCTION of the MEAN HOURLY TEMPERATURES in the individual Years 1849–1868.

Year.	A_1.	B_1.	A_2.	B_2.	A_3.	B_3.	A_4.	B_4.
1849	−4·105	−2·454	+0·822	+0·498	+·134	+·138	−·068	−·013
1850	−4·316	−2·753	+0·817	+0·524	+·101	+·136	−·060	−·038
1851	−4·287	−2·728	+0·907	+0·512	+·064	+·117	−·053	−·005
1852	−4·367	−2·717	+0·936	+0·643	+·046	+·106	−·060	−·049
1853	−3·822	−2·225	+0·753	+0·494	+·107	+·125	−·067	+·040
1854	−4·693	−3·194	+1·049	+0·670	+·034	+·143	−·078	−·058
1855	−4·281	−2·698	+0·918	+0·597	+·022	+·195	−·029	−·036
1856	−4·024	−2·633	+0·963	+0·501	+·065	+·096	−·065	−·014
1857	−4·624	−2·882	+1·004	+0·589	+·073	+·167	−·088	+·003
1858	−4·636	−3·017	+0·993	+0·571	+·006	+·102	−·045	−·002
1859	−4·452	−2·793	+0·891	+0·680	+·051	+·102	−·030	−·024
1860	−3·720	−2·324	+0·794	+0·567	+·045	+·079	−·027	+·003
1861	−4·256	−2·661	+0·820	+0·621	+·054	+·057	−·038	+·013
1862	−3·550	−2·295	+0·645	+0·475	+·029	+·099	−·014	·000
1863	−4·381	−2·701	+0·885	+0·565	+·077	+·049	−·067	−·052
1864	−4·394	−3·021	+0·948	+0·571	+·050	+·089	−·065	−·025
1865	−4·689	−3·171	+0·971	+0·672	+·025	+·146	+·029	−·048
1866	−4·086	−2·512	+0·783	+0·516	+·077	+·166	+·006	−·014
1867	−3·986	−2·479	+0·759	+0·492	+·089	+·119	−·023	+·002
1868	−4·900	−3·106	+0·918	+0·488	+·100	+·184	−·027	−·029
Mean -	−4·278	−2·718	+0·879	+0·562	+·062	+·122	−·043	−·016

DIFFERENCES of the COEFFICIENTS from the MEAN, in thousandths of a Degree.

Year.	A_0.	$-A_1$.	$-B_1$.	A_2.	B_2.	A_3.	B_3.	$-A_4$.	$-B_4$.
1849	+ 630	−173	−264	− 57	− 64	+72	+16	+25	− 3
1850	− 170	+ 38	+ 35	− 62	− 38	+39	+14	+17	+22
1851	− 310	+ 9	+ 10	+ 28	− 50	+ 2	− 5	+10	−11
1852	+ 940	+ 89	− 1	+ 57	+ 81	−16	−16	+17	+33
1853	−2150	−456	−493	−126	− 68	+45	+ 3	+24	−56
1854	− 460	+415	+476	+170	+108	−28	+21	+35	+42
1855	−2520	+ 3	− 20	+ 39	+ 35	−40	+73	−14	+10
1856	− 550	−254	− 85	+ 84	− 61	+ 3	−26	+22	− 2
1857	+1550	+346	+164	+125	+ 27	+11	+45	+35	−19
1858	− 190	+358	+299	+114	+ 9	−56	−20	+ 2	−14
1859	+1180	+374	+ 75	+ 12	+118	−11	−20	−13	+ 8
1860	−2120	−558	−394	− 85	+ 5	−17	−43	−16	−19
1861	+ 340	− 22	− 47	− 59	+ 59	− 8	−65	− 5	−29
1862	+ 250	−728	−423	−234	− 87	−33	−23	−29	−16
1863	+ 970	+103	− 17	+ 6	+ 3	+15	−73	+24	+36
1864	− 730	+116	+308	+ 69	+ 9	−12	−33	+22	+ 9
1865	+1180	+411	+453	+ 92	+110	−37	+24	−72	+32
1866	+ 710	−192	−206	− 96	− 46	+15	+44	−49	− 2
1867	− 890	−292	−239	−120	− 70	+27	− 3	−20	−18
1868	+2330	+622	+388	+ 39	− 74	+38	+62	−16	+13
Mean -	1085	278	220	139	56	26	31	23	20
Do. ÷ $\sqrt{20}$	242	62	49	31	12	6	7	5	4

The calculations were pretty carefully checked. In the steps of the calculations I never went beyond the third decimal of a degree, and therefore this figure is liable to an error amounting to a few units. With this understanding, the mean of the reductions agrees with the reduction of the mean previously given (Minutes, p. 20), which was calculated quite independently, so that the two check each other.

The last line is given as allowing an estimate to be formed of the mean errors of the coefficients derived from different groups of 20 independent years compared with the coefficients which would be obtained from an infinite number of years.

The general conclusions obtained in my former memorandum in an indirect way are borne out by the direct comparison between different years which is here made. As before observed, the minute fourth order is swallowed up, even in the mean of a 20 years' series, by the uncertainty in the amount of diurnal fluctuation, not to speak of the much larger uncertainty in the mean temperature for a day. Nevertheless, it appears from the figures that though this order is so minute, and though its effect on the mean temperature at any particular hour is trifling compared with the average variation from year to year of the mean for that same hour, it still emerges roughly with tolerable certainty from the mean for a good number of years.

If we were in possession of a theory by which mean temperatures could be calculated with the same precision as the planetary motions, there would then be some interest in working out from observation this fourth order, though so minute. But as there appears to be no prospect of such a theory, and as it seems hardly conceivable that so minute a feature of the diurnal fluctuation could assist us in the endeavour to connect observed meteorological effects with their causes, it does not seem advisable to incur the additional labour and expense that would be involved in the endeavour to elicit from observation such very small fluctuations.

M.O. 1648.

STATEMENT of WORK done in MARINE ROOM during June 1879.

July 7, 1879.

New Logs examined.—13 in number.

Winds for 3 Nn. Cape Squares; completed working of sum forces to replace mean force in results for single degree squares.

Winds for 3 Sn. Cape Squares; the tabulation and all working for single-degree squares is about one half completed.

Sea-Surface Temperatures in 3 Sn. Squares.—During one half of the month one person was wholly engaged grouping the sea temperatures, but owing to computor's slow rate of working, very little progress has been made.

Cape Gale Tables.—A short time devoted to specimen plates and diagrams to illustrate January Results.

Pacific Charts of Sea Temperature and Currents.—May Charts nearly completed for M.O. Logs.

Collection of Data in Indian Ocean.—Considerable progress has been made in this work, and the part necessary to be done by ordinary staff is fully three weeks in advance of work done by supernumerary staff, so that ordinary staff will be practically freed from this work for the present.

Considerable progress has also been made in the examination of Data Books for February–June, prior to their being forwarded to India.

R. H. Scott, Esq. (Signed) CHARLES HARDING.

M.O. 1649. PANTAGRAPH ROOM. June 30, 1879.

The following statement shows the progress made during *June*, with the production of Quarterly Weather Report Plates for the present year:—

Copper Plates.—*Seven* plates have been pantagraphed during the month, Nos. 16–22, and the date is thus brought up to April 20th.

Zinc Plates have been pantagraphed as follows:—

Barograms, 8 plates, Nos. 16–23; Thermograms, 8 plates, Nos. 17–24; Anemograms, 8 plates, Nos. 18–25; Rain Curves, 7 plates, Nos. 17–23; Vapour Tension, 7 plates, Nos. 16–22.

Photographic Curves have been ruled and checked to Plate 24, both for barograms and thermograms.

The new Galton Pantagraph was received from Messrs. Beck on the 9th, after a necessary alteration had been effected in it. It now works satisfactorily.

The March tabulations have been checked and the Remark Sheets written; the work was passed to the "Computing Room" on the 6th. Since then the April work has been received from Mr. Allen (on the 9th), and the writing of the Remark Sheets for that month is now in progress.

Mr. Allen's report is attached.

R. H. Scott, Esq., F.R.S. (Signed) R. H. CURTIS.

EXAMINATION ROOM, LAND OBSERVATORIES DEPARTMENT.

SIR, June 25, 1879.

IN my last report (23rd May) I mentioned "of the work for April, part of the thermograms for all stations is done." The April work has since been completed, and was passed into the Pantagraph Room on the 19th instant.

During the examination of the April work I was absent on *nine* days, and Mr. Aldridge on *two*.

We are now engaged on the work required for the Registrar General for Ireland, and the examination of the returns from the two Irish stations for May is nearly completed.

R. H. Scott, Esq., M.A., F.R.S., (Signed) T. E. ALLEN.
Secretary, Meteorological Council.

Submitted—A comparison between uncorrected readings of barometers and aneroids from four ships (Minutes 1878, p. 134), which was referred to Mr. Galton.

The Council then adjourned.

116, *Victoria Street, July* 11, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of last meeting (July 7) were read and confirmed.

Brigadier General Myer (Chief Signal Officer, U.S. Army) attended the meeting, and a précis of his remarks are kept in the form of a letter (M.O. 1706).

After his withdrawal, it was resolved that a letter be addressed to the Admiralty requesting that simultaneous observations at 0h. 43 p.m. Greenwich mean time be taken on board the ships of Her Majesty's Navy, and transmitted at short intervals to the Meteorological Office, and the Hydrographer was requested to confer with the Chairman as to the terms of the letter.

A form for the Quarterly Summaries of the Weekly Weather Report was submitted by Mr. Galton and approved. It was ordered that quarterly summaries on this form should be prepared for the present year.

The subject of the continuation of the issue of the lithographed hourly readings at the observatories (Minutes, 1878, p. 72) was considered (Letter 1202), and it was resolved that their issue be continued for the year 1879, and that the daily mean values be given on the sheets, but that in order to save time in the Office the readings should be copied on ordinary, instead of lithographic transfer, paper.

Read—The following letter in reply to certain inquiries addressed to Mr. Gaster in connexion with the Forecast Service (Minutes, pp. 30, 31) :—

M.O. 1640.

SIR, July 7, 1879.

I BEG to return the following replies to queries put to me some time since by the Council, with reference to a proposed increase in the number of stations whence telegraphic weather reports are received daily.

1. As to making the present *temporary* increase in the number of the 2 p.m. reports permanent.

I think that although every additional 2 p.m. report is of great service in the work of "forecasting," the stations from which we usually receive such telegrams are, *as a rule*, ample; and that the money required to increase them might be more profitably disposed of as follows:—(A.) In obtaining, freely, special telegrams during periods of very disturbed weather, or of exceptional distribution of pressure. (B.) In defraying to some extent the cost of procuring telegrams from foreign stations situated at great distances from us.

2. As to the possibility of giving Forecasts (of a *general* nature) for more than one day in advance, supposing that telegrams could be obtained from a greater distance than they are now.

I think there is very little, if any, doubt on this head. With daily telegrams from a more extended area our present Forecasts would be greatly improved, and we could frequently give a general Forecast, such as "South-westerly winds, and cloudy showery weather probable for several days." I do *not* think that such Forecasts could be drawn up *daily* as a *regular* undertaking at present, but such a statement might be made occasionally with quite as much certainty as our present Forecasts are for this country. The weather comes to us in *systems* whose motion appears to be dependant on the general distribution of pressure over distant regions. Frequently the systems are too large for us (with our small area of observation) to know anything of the distribution of pressure which governs their motion, and we find ourselves deplorably mistaken in our Forecasts. I look to information from distant stations to set that matter right, and to accurate and detailed information from the home stations, in order to know the nature of the changes which are going on *in* the systems themselves.

I can set *no* limit to regions from which such telegrams might be received with advantage, but the most urgently needed seem to be—1 near Bodö, in Norway; 1 near Helsingfors or St. Petersburg; 4 or 5 in Germany and Austria (positions to be selected); 1 each, at Rome, Barcelona, Alicante, Lisbon, Oporto, and, were it *possible*, the Azores.

Information from still greater distances (so far as Europe is concerned) is supplied pretty regularly in the bulletin, and, though it is not received till 24 hours after the observations are taken, is of great value even then; the great thing wanting hitherto having been *time* in which to study them.

I am, &c.

R. H. Scott, Esq. FREDERIC GASTER.

Mr. Scott was instructed to report in detail as to the cost of the proposals in Mr. Gaster's memorandum, and also to ascertain the cost of a daily telegram from America.

A letter from Sir H. Lefroy (No. 1304) with reference to the physical globe, (Minutes, p. 122) was read. Mr. Scott was instructed to endeavour to obtain papers for covering one of the globes now in the Office, or otherwise to obtain for the use of the Office a smaller globe than that originally contemplated by Sir H. Lefroy.

Mr. Galton reported that the data for comparison of aneroid and barometer readings at sea (Minutes, p. 46) were insufficient for the inquiry he had in view, owing to the large instrumental error of two out of the four aneroids employed.

Resolved—That Mr. J. N. Douglas, the engineer to the Trinity House, be asked if observations of barometers and aneroids, and also of barometers with their gimbal suspension altered (Minutes, 1878, p. 131), could be taken on board the tender employed in the construction of the new Eddystone lighthouse.

With reference to the preparation of a barometer scale with verniers graduated only to read hundredths of an inch (Minutes, 1878, p. 144), Mr. Scott reported that he had submitted to Professor Stokes old pattern barometers with such scales. It was agreed that the proposed alteration of the barometer scales be not carried out, pending the result of the experiments on the alteration of the mode of suspension.

Submitted—The following table of the falling times of the Marine Barometers tested for the Office at Kew during the year 1878 (Minutes, 1878, p. 133):—

LIMIT of TIME ALLOWED to MARINE BAROMETERS for falling one inch is from three to six minutes. Distance of falling is from 1·5 inch above atmospheric pressure to 0·5 inch.

Date.	Maker's Name.	Mark and Number.	Time of falling one inch.	Date.	Maker's Name.	Mark and Number.	Time of falling one inch.
1878.			m. sec.	1878.			m. sec.
August -	Adie - -	C. 470	5 10	August -	Neg. & Zambra	A. 8	4 30
„ -	„ - -	471	6 0	„ -	„	12	3 40
„ -	„ - -	472	5 32	„ -	„	27	3 38
„ -	„ - -	473	5 10	„ -	„	51	3 40
„ -	„ - -	474	3 45	„ -	„	3	5 50
„ -	„ - -	475	3 40	„ -	„	438	3 20
„ -	„ - -	476	4 35	„ -	„	11	3 25
„ -	„ - -	477	4 38	„ -	„	17	3 12
„ -	„ - -	478	4 32	„ -	„	206	3 25
„ -	„ - -	479	4 40	September -	„	183	3 5
„ -	„ - -	480	4 15	„ -	„	249	4 45
„ -	„ - -	481	3 10	„ -	„	14	2 58
„ -	„ - -	482	4 25	„ -	„	328	4 0
„ -	„ - -	483	4 20	„ -	„	81	3 35
„ -	„ - -	484	4 40	„ -	„	85	3 35
„ -	„ - -	485	5 35	„ -	„	89	3 5
„ -	„ - -	486	5 55	„ -	„	6	3 4
„ -	„ - -	487	4 5	„ -	„	14	3 0
„ -	„ - -	488	4 12	„ -	„	23	3 7
„ -	„ - -	489	5 10	„ -	„	46	3 18
„ -	„ - -	490	5 0	„ -	„	67	3 15
„ -	„ - -	491	5 0	„ -	„	68	3 24
„ -	„ - -	492	4 50	„ -	„	72	3 20
„ -	„ - -	493	4 35	November -	„	4	4 40
„ -	„ - -	494	4 15	December -	„	285	3 20
„ -	„ - -	495	3 15	„ -	„	396	4 45
„ -	„ - -	496	5 5	„ -	„	406	5 5
March -	„ - -	A. 233	3 3	January -	Adie - -	B. T. 349	5 16
„ -	„ - -	239	4 0	March -	Elliott Bros. -	21	3 43
„ -	„ - -	249	3 36	„ -	Adie - -	37	3 45
„ -	„ - -	305	4 17	„ -	„ - -	127	3 7
„ -	„ - -	319	3 59	„ -	„ - -	176	3 25
„ -	„ - -	351	3 44	„ -	„ - -	318	3 13
July -	Neg. & Zambra	124	3 0	„ -	„ - -	350	5 25
„ -	Adie - -	250	5 40	„ -	„ - -	452	3 1
„ -	Neg. & Zambra	16	4 8	July -	„ - -	15	4 5
„ -	„	30	3 38	„ -	„ - -	132	4 34
„ -	„	53	4 8	„ -	„ - -	165	5 53
„ -	„	55	5 0	„ -	„ - -	218	3 35
„ -	„	63	5 32	August -	„ - -	75	5 10
„ -	„	71	4 0	„ -	„ - -	48	3 25
„ -	„	16	4 8	„ -	„ - -	5	3 20
„ -	„	30	3 38	September -	„ - -	421	3 25
„ -	„	86	3 10	„ -	„ - -	288	3 15
„ -	„	87	2 55	December -	„ - -	103	5 10

NOTE.—C. indicates instruments bought on commission; A. Admiralty instruments; B. Board of Trade instruments.

Kew, June 25, 1879. (Signed) G. M. WHIPPLE.

Mr. Scott asked for instructions as to sending additional barometers to the observatory at Cape Town as proposed (Minutes, 1878, p. 129).

It was resolved that additional barometers be sent to Mr. Gill, if in the opinion of the Secretary it be found desirable to do so.

The Hydrographer was authorised to confer with a gentleman whom he considered likely to be of use as an assistant in the Marine Department.

The Council then adjourned.

116, *Victoria Street, July* 14, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (July 11) were read and confirmed.

The Chairman reported on the subject of the draft of the Weather Guide (Minutes, p. 41).

It was resolved that the title of the work should be "Aids to the Study and Forecast of Weather." The final issue was entrusted to the Chairman and Mr. Galton, with a view to the publication of the book, if possible, on the 1st of September.

The Secretary submitted the following correspondence relative to the receipt of telegraphic information from Switzerland (Minutes, p. 31):—

P.C. 1735.

MY DEAR SIR, Meteorological Office, London, July 8, 1879.

I AM instructed by the Council to ask if you could possibly undertake to forward to me, daily, a telegraphic despatch, say of 50 or 60 words, giving a general account of the weather in Switzerland. If you were able to give the information, we might inquire as to the cost of transmission.

Yours, &c.

Professor R. Billwiller. (Signed) R. H. SCOTT.

M.O. 1679.

SIR, Zürich, July 11, 1879.

WITHIN the last few days I have been on the point of writing to you, to inquire whether it would not be possible to arrange for an exchange of meteorological reports between England and Switzerland.

We have introduced Weather Telegraphy into our country, as an experiment, since 1st May; the provisional organisation being as follows:—

Zürich receives in the afternoon observations taken at 7h. a.m. and 1h. p.m. at seven Swiss stations, besides collective telegrams from Florence and Hamburg. The latter gives the data BBBWW SHTTT from 17 stations (including Aberdeen and Roche's Point). We also receive a telegram from Paris, containing a *résumé* of pressures (isobars).

We send, in exchange, a collective telegram from Swiss stations to Hamburg and Florence. These telegrams are international, and go free.

We are endeavouring to obtain the actual observations from some French and English stations, instead of the present Paris message; M. Mascart informed us, however, in reply to inquiries made in November, that he could only give us the French observations.

A report direct from England (a collective telegram for about eight stations) is greatly desired by us, and its free transmission would meet with no difficulty on the part of the Swiss Telegraphic Administration. If the English Telegraphic Authorities would also give their consent to it, we could both attain our end easily and without expense.

I venture therefore to request that you will kindly make the necessary inquiries. A telegram of 60 words from Switzerland to England costs 17*s.* 6*d.*, without a reduction of tariff. I do not know whether such a reduction is obtainable, if, as I hope will be the case, the exchange of telegrams should not be quite free.

As far as I gather from your letter of 8th July, you do *not* wish for the actual observations from a number of Swiss stations, but rather a *résumé* in words as to the weather in Switzerland, in which, of course, individual temperature indications, maxima, minima, &c. would not be included. I am quite ready to draw up such a special report regularly for your object.

In our Weather Report issued to the public we must of course also give a short account of the general atmospheric conditions over Europe, which would be superfluous for you. I can, however, easily separate, in future, the part referring to the state of the weather in Switzerland from the general account, and send you the former only. Will you, however, please let me know whether you wish for a morning or an afternoon telegram. In the first case we must, as indeed is intended, make a change in the organisation of our inland Weather Reports; as we have hitherto only received the reports between 1h. and 2h. p.m. The *present* Weather Bulletin, of which only a few copies are issued, one of which is enclosed, possesses no value for foreign central offices. I hope, however, later on, to be able to improve it by the addition of a chart, representing graphically the peculiar conditions in the distribution of the atmospheric pressure, which often show an exceedingly st ep

gradient from the North to the South of the Alps. For this purpose it will be necessary to choose a different normal level than that of the sea for the reduction of the barometer readings; for instance, 500 metres for valley stations, and perhaps 1,500 metres for mountain stations.

We are endeavouring to improve our high stations, to provide them with good observers, and then to get telegraphic reports from them. Our present station on the St. Gothard is only a pass station, and is very far from giving results such as we might expect from a peak station.

Awaiting your further communication,

Accept, &c.

R. H. Scott, Esq.
Secretary, Meteorological Council, London.

(Signed) R. BILLWILLER.

It was resolved that a specimen telegram be obtained from Dr. Billwiller by post, and that the question of the cost of transmission be brought before the Postmaster General.

The Secretary reported (Minutes, p. 33) that the daily cost of printing the Forecasts at Messrs. Wightman's printing office was 8*s*. (for 60 copies at 11 a.m. and 310 at 4 p.m.), and that he had learned that a press suitable for use in the Office could be had for about 45*l*. He was instructed to continue the present arrangement during the vacation, and the question of purchasing a printing press was referred to Mr. De La Rue.

Professor Stokes made a further report on the subject of the proposed bridled anemometer for use at lighthouses (Minutes, 1878, p. 112).

The subject was again referred to him and to Mr. De La Rue, with authority to order one of the instruments, and to carry out the views of the Trinity House in any way they might find possible.

With reference to the request of the Board of Trade for an anemometer suitable for use at Sombrero (Minutes, 1878, p. 89), it was resolved that an anemometer specially adapted for the service be ordered from Messrs. Munro.

The Secretary reported that the subject of connecting Mr. Hankey's anemometer on Queen Anne's Mansions with signalling apparatus belonging to the Office (Minutes, p. 44) had been brought under the notice of the managers of that building.

The Secretary was instructed to return Professor von Oettingen's anemometer (Minutes, 1878, p. 109) to the guarantors of the Loan Exhibition, 1876, with the thanks of the Council.

He was also instructed to obtain from Kew a fresh report on the performance of the anemometer modified on a plan proposed by Mr. De La Rue, so as to give hourly velocities directly. (Minutes, 1871, p. 10; 1872, p. 89.)

Mr. De La Rue exhibited his evaporation gauge, which had been modified since last submitted (Minutes, 1878, p. 130). It was agreed that the instrument should be sent to his laboratory for experiments to be made with it by him.

With reference to the experiments on hygrometry (Minutes, p. 44), the Chairman and Professor Stokes reported that they were prepared to recommend Mr. W. N. Shaw, M.A., Fellow of Emmanuel College, Cambridge, as a fit person to carry on the experiments; and it was resolved that Mr. Shaw be requested to undertake the inquiry at a remuneration not exceeding 50*l*., the chemical method to be employed as proposed (Minutes *l.c.*), and with it to be compared the dry and wet bulb hygrometer, Regnault's, Dines', Alluard's, and the hair hygrometer.

Submitted—The MS. of "Contributions to Arctic Meteorology, Part II." (Minutes, 1877, p. 79; 1878, pp. 1, 90), with a memorandum by Mr. Strachan. (Letter 1721.) The paper was referred to General Strachey.

The Secretary was instructed to direct Mr. Strachan to continue the reduction of the old sea temperature observations (Minutes, 1878, p. 128), and to prepare a form for the discussion as soon as possible.

The subject of the Cape Gales was taken into consideration (Minutes, 1878, p. 106). Captain Toynbee having submitted a draft paper on the gales for January, which had been examined by Mr. Galton, the following resolutions were taken—That the Marine Superintendent be requested—

1. To prepare a tabular statement of all the gales for the Cape district for each month, keeping separate the gales met with by outward and homeward bound ships, and appending a statement of the wind and barometrical readings at Cape Town at the time of each gale.
2. To chart the track of each ship reporting a gale for the time during which she experienced it, indicating her position on each day.

The Council would wish the four months of January, April, July, and October to be dealt with first.

Mr. Galton was requested, in conjunction with the Chairman, to draw up the heads of the above-mentioned tabular statement.

The question of the salaries of the Staff was taken into consideration, and letters 2376 (1878) from Mr. C. Harding, and 581 (1879) from Mr. R. Curtis were read.

It was resolved, with reference to the maximum salary for the Senior Clerks, fixed Minutes, 1875, p. 32, that the salaries of Messrs. Gaster, C. Harding, and R. Curtis be raised to 200*l.* a year, at the six hours rate of pay; and as regards Messrs. Brodie, Bell, and Francis, who have not yet reached their respective maxima (Minutes, *l.c.*), that Mr. Brodie receive an increase of 7*l.*, and Messrs. Bell and Francis an increase of 5*l.* each, at the six hours rate of pay, and that they receive a similar rise next year, which will bring them each to his maximum.

Resolved—That Mr. Scott be instructed to inform the Staff that the rules of the Departments of the Civil Service in respect of salaries cannot in any way be adopted in the Meteorological Office.

Reported—That Mr. R. G. Canham, who had been admitted on probation into the Land Meteorology Room, at a salary of 30*s.* per week (on the eight hours rate of pay) (Minutes, 1878, p. 117), had been working very satisfactorily, and had accordingly been placed on the regular temporary staff, at the same rate of pay.

The salary of Mr. Cullum, Superintendent of Valencia Observatory, was raised from 180*l.* to 190*l.*, in accordance with agreement (Minutes, 1875, p. 77).

Submitted—The following abstract of accounts from 1st April to 30th June 1879 :—

Income.	£	s.	d.
Balance from year 1878–9	709	9	10
Vote for year 1879–80 £ s. d.			
paid 3,375 0 0			
Do., amount unpaid 11,125 0 0			
	14,500	0	0
Supply of Information:			
Weather Reports for newspapers, &c., including 6h. p.m. observations	135	9	8
Repayments for telegrams, subscriptions for D.W. Charts, &c.	201	8	0
Subscriptions for 11h. a.m. and 4h. p.m. Forecasts and inquiries	19	11	6
Ocean Statistics	82	15	2
Miscellaneous data	0	16	6
Sale of Instruments, &c.:			
Mercantile marine account	20	16	6
Royal Navy „	3	6	0
Repayments of expenses charged under:			
(1) Incidental expenses	2	3	0
(2) Observatories, &c.	3	0	0
Commission on work for Colonies, &c.	3	11	8
Total	£15,682	7	10

Expenditure.	£	s.	d.
Council	250	0	0
Secretary	200	0	0
Special researches and experiments	37	17	3
Salaries and wages (Office expenses)	175	3	9
Rent, fuel, and lighting	136	1	0
Incidental and contingent expenses	79	19	3
Observatories and other stations	604	18	0
Discussion and reduction of observations (land)	340	4	5
Telegrams, storm warnings, and reporters	661	2	2
Preparation, issue, and discussion of Weather Reports	333	19	8
Forecast expenses	33	5	1
Inspectors (salaries)	75	0	0
„ (expenses)	0	7	0
Royal Navy: supply of instruments	58	6	0
„ other expenses	1	1	6
Mercantile Marine: supply of instruments	47	13	6
„ other expenses	59	16	0
Distant Stations	1	5	0
Reduction and discussion of observations (ocean), and care of instruments	560	1	10
International Meteorology	80	3	3
Balance	11,946	3	2
Total	£15,682	7	10

Liabilities.	£	s.	d.
To Post Office (partly estimated)	358	13	4
„ sundry creditors	515	14	5
„ „ (contracts or work uncompleted)	356	17	10
„ Council	250	0	0
„ balance	11,946	3	2
Total	£13,427	8	9

Assets.	£	s.	d.
By cash at bank	1,611	13	6
„ „ „ Office	218	17	5
„ „ „ Valencia	50	0	0
„ sundry debtors	421	17	10
„ H.M. Exchequer	11,125	0	0
Total	£13,427	8	9

Read—Letter 1017 from the Meteorological Society, asking if the allowances made in 1878, viz., 102*l.* 10*s.* for supply of observations and of 25*l.* towards the cost of inspections, would be continued for the year 1879.

The Secretary was instructed to reply that no change would be made.

The Chairman reported (Minutes, p. 39) that the rent asked for the ground floor of No. 116, Victoria Street was 200*l.*, and the accommodation insufficient. The Chairman and Secretary were authorised to treat for Mr. Barry's rooms in No. 113 (Minutes, 1878, p. 89).

Read—A letter (No. 1433) from the Secretary to the Royal Cornwall Polytechnic Society, requesting the Council to pay some part of the charges, amounting to 17*l.* 16*s.*, made by Mr. Olive, a local optician, for keeping the instruments at Falmouth Observatory in order, and for attendance on Mr. Whipple on inspections.

The Secretary was authorised to pay a sum of 8*l.* 10*s.* towards Mr. Olive's bill.

The Secretary was authorised to make arrangements to heat the Marine Room with hot water, and to erect additional shelving in some of the rooms.

Resolved—That the Kew Committee be requested to allow Mr. Whipple to inspect the observatories in 1879 as usual.

The Council then adjourned till October,

Mr. De La Rue being requested to act as a committee with the Chairman for any business which might arise in the interval.

116, *Victoria Street, October* 4, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. GALTON.	PROFESSOR STOKES.
GENERAL STRACHEY.	THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (July 14) were read and confirmed.

The Chairman reported that he had received a revised proof of "Aids to the Study and Forecast of Weather," Minutes (p. 49), and that the illustrations to the book were in the engraver's hands.

Professor Stokes reported with reference to the bridled anemometer (Minutes, p. 49) that Mr. Munro had prepared a working drawing, and a tracing of it. It was agreed that he should be asked to furnish estimates, (i.) for an instrument giving a continuous record; (ii.) for an instrument giving simple indications.

Reported—That Mr. De La Rue had sent his evaporation gauge (Minutes, p. 49) to Kew to be tested.

Read—The following letter:—

M.O. 2241.

SIR, Colonial Office, September 11, 1879.

I AM directed by the Secretary of State for the Colonies to inform you that he has had under consideration your letter of the 14th of March last, placing him in possession of the details of the scheme for prosecuting meteorological observations in the West Indies, and that before communicating on the subject with the Governors of the West Indian Colonies, Sir Michael Hicks Beach would be glad to be informed whether the Meteorological Council could not recommend for adoption, in the first instance, some scheme which might be worked by a less expensive staff than that which they have proposed, dispensing with the services of the Naval Officer, and allowing much less remuneration for the assistants, as it would seem preferable to make a small beginning rather than to incur the risk of the proposal being allowed to fall to the ground on account of its costliness.

I am, &c.

The Secretary to the Meteorological Council. (Signed) EDWARD WINGFIELD.

The Chairman was requested to prepare a draft reply for consideration by the Council.

Read—A letter from Captain Toynbee (No. 2,411). The Chairman was requested to reply to it verbally.

Submitted—The following report on the condition of the work in the Marine Room:—

CAPE OF GOOD HOPE DISTRICT.

All materials contained in Meteorological Office Logs, Admiralty Logs, Dutch extracts, etc., have been extracted into Data Books, and refer to the following subjects:—

Currents, Sea Temperature, Winds, Barometer, Thermometer—dry and wet, Cloud—form aud amount, Weather, Sea Disturbance, Specific Gravity, and Remarks.

The first three of these subjects are the only ones as yet taken up, and the progress made in each is as follows:—

Currents.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Charted - - - -	*			*								

Sea Temperatures.

Tabulated and summed under each degree Faht. for each single degree square.	*	*	*	*	In hand.	In hand.	*	In hand.	In hand.	In hand.	In hand.	In hand.
Grouped similarly to winds, and for similar areas.	*			*								

Winds.

Tabulated and summed in 1° squares -	*	*	*	*	*	*	*	In hand.	*	*	*	*
Grouped into natural areas for wind-roses.	*			*			*			*		
Engraved on copper plate - -	*			*			*			*		
Printed - - - -	*			*			*			*		

Gales of Cape District.

Grouped on six forms, separated into outward and homeward, and for each 10° of longitude.	*						*					

PACIFIC OCEAN—SEA TEMPERATURES AND CURRENTS.

Meteorological Office logs plotted -		*			*							
Admiralty Remark Books - -		*			*							

* Signifies that the data have been discussed or worked up to the stage specified.

September 30, 1879. HENRY TOYNBEE.

Mr. Galton submitted a memorandum on the discussion of the Wind-rose Charts of the Cape Squares, which was ordered to be lithographed and circulated.

Resolved—That the Wind-rose Chart for August be prepared.

Mr. Galton was requested to give instructions for the preparation of the revised Wind-roses, the revision for January to be undertaken first.

Resolved—(i.) That the air temperature of the Cape Squares be meaned and plotted for single-degree squares, on the same scale as the currents, for the months of January and July; the number of observations in each square being given.

(ii.) That the sea temperature be laid down on charts, with roses showing the deviations from the isotherms; Mr. Galton undertaking to give instructions for the preparation of these Charts.

Reported—That the extraction of data for the India Office would probably be completed by the middle of October. The Chairman reported that, with the view of accelerating the progress of this work, he had authorised Mr. Charles Harding and Mr. Allingham to work overtime from August 9 to September 30, at the examination of the Indian logs.—Approved.

SUBMITTED—The following STATEMENT respecting the RECORDS for May 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :—	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Fair.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Good.	Direction. Fair.	Velocity. Good.
Action														
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orientation verified	31st	—	31st	—	9th	—	4th	—	2nd	—	28th	—	8th	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	1	0	0	0	0	0	0	1
„ „ irregular differences	0	0	0	1	0	0	0	2	0	5	0	0	0	1
Result of 40 *Remeasurements* :—														
Greatest difference	0·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	1·0	2·0	1·0	1·0	0·0	2·0
Mean difference irrespective of sign	0·0	0·5	0·0	0·4	0·1	0·5	0·0	0·3	0·1	0·3	0·1	0·4	0·0	0·6
Residual difference (—Meteorological Office)	0·0	+0·2	0·0	0·0	0·0	+0·3	0·0	0·0	−0·1	+0·1	+0·1	+0·1	0·0	+0·1

RAIN GAUGE :—														
Action	Fair.		Fair.		Indifferent.		Fair.		Fair.		Good.		Fair.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		*25 hrs.		0		0	
Errors in tabulation	0		0		1		0		0		1		0	

BAROGRAPH :—

Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Indifferent.	Do.	Indifferent.	Do.	Do.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	0	†3 hrs.	0	0	0	0	‡2 hrs.
No. of errors discovered—						0	
In entry of standard	0	4	3	8	1	0	0
„ calculating residual correction	0	0	1	0	0	0	0
„ applying residual correction	0	1	3	3	0	0	1
„ subtraction in subsidiary tables	0	0	1	0	0	0	0
„ tabulation by subsidiaries	0	1	0	0	0	0	0
„ „ irregular differences	0	0	0	1	1	1	0
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·007	0·005	0·010	0·007	0·010	0·005
Mean difference irrespective of sign	0·0023	0·0028	0·0026	0·0029	0·0027	0·0025	0·0022
Residual difference (—Meteorological Office)	+0·0013	−0·0007	+0·0008	−0·0005	0·0000	−0·0004	+0·0007
Mean monthly difference between simultaneous Barograph and Barometer readings	0·0016	0·0021	0·0020	0·0014	0·0021	0·0017	0·0014

THERMOGRAPH :—

Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Indifferent.		Do.		Indifferent.		Do.		Do.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	1 hr.	1 hr.	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	0	1 hr.
„ „ imperfectly moistened bulbs	—	0	—	0	—	11 hrs.	—	1 hr.	—	8 hrs.	—	13 hrs.	0	0
„ „ partially frozen bulbs	—	0	—	0	—	0	—	0	—	0	—	0	0	0
„ „ other causes	§10 hrs.	0	13 hrs.	‖2 hrs.	0	0	0	0	‖1 hr.	0	0	0	0	0
No of errors discovered in entry of Standard	0	0	0	1	0	0	1	0	0	0	0	0	1	1
„ „ by subsidiary measurements	0	0	0	0	0	0	1	0	0	0	0	0	2	0
„ „ of subtraction in do. tables	0	0	1	2	1	0	2	0	7	3	0	0	3	0
„ „ detected under glass scale	6	0	21	7	3	3	6	7	13	2	2	5	10	4
Result of 40 *Remeasurements :—*														
Greatest difference	0·3	0·2	0·3	0·4	0·3	0·3	0·2	0·3	0·3	0·5	0·3	0·3	0·4	0·4
Mean difference irrespective of sign	0·11	0·07	0·10	0·12	0·10	0·09	0·09	0·11	0·12	0·14	0·10	0·14	0·17	0·12
Residual difference (—Meteorological Office)	−0·10	−0·01	−0·08	+0·03	−0·05	+0·06	+0·03	−0·08	−0·09	+0·01	+0·07	+0·07	+0·13	+0·01
Mean monthly difference between simultaneous Thermograph and Thermometer readings	0·16	0·24	0·14	0·17	0·08	0·10	0·22	0·19	0·18	0·21	0·12	0·19	0·14	0·25
No. of errors in maxima and minima	2	—	4	—	3	—	5	—	9	—	0	—	8	—

• Tube partially choked. † Cylinder badly started. ‡ Lamp glass smoked. § Light-stop acting badly. ‖ Bad photography.

SUBMITTED—The following STATEMENT respecting the RECORDS for June 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

——	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :— Action	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Fair.	Velocity. Good.	Direction. Fair.	Velocity. Good.
Records deficient, due to stoppage of clock	0	0	24 hrs.	24 hrs.	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orientation verified	30th	—	30th	—	16th	—	12th	—	6th	—	20th	—	12th	—
No. of errors discovered by subsidiaries	0	0	1	0	0	0	0	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	0	0	1	0	1	0	2	2	1	2	1
Result of 40 *Remeasurements* :—														
Greatest difference	0·0	1·0	0·0	1·0	0·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	0·0	2·0
Mean difference irrespective of sign	0·0	0·3	0·0	0·3	0·0	0·6	0·0	0·5	0·0	0·6	0·0	0·4	0·0	0·7
Residual difference (— Meteorological Office)	0·0	−0·1	0·0	+0·1	0·0	+0·2	0·0	+0·1	0·0	0·0	0·0	0·0	0·0	−0·1
RAIN GAUGE :— Action	Fair.		Fair.		Indifferent.		Fair.		Fair.		Good.		Fair.	
Records deficient, due to stoppage of clock	0		16 hrs.		0		0		0		0		9 hrs.	
„ „ other causes	0		0		0		0		*6 hrs.		*3 hrs.		0	
Errors in tabulation	0		1		0		0		1		0		1	

BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good	Good.
Photography	Do.	Do.	{1st half.—Indifferent. {2nd „ Good.	Do.	Indifferent.	Do.	Do.
Records deficient, due to stoppage of clock	0	2 hrs.	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	†4 hrs.
No. of errors discovered—							
In entry of standard	1	0	1	4	3	0	1
„ calculating residual correction	0	0	3	4	1	0	0
„ applying residual correction	0	0	0	2	1	2	7
„ subtraction in subsidiary tables	0	0	0	2	2	0	3
„ tabulation by subsidiaries	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	0	0	0	1
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·005	0·005	0·005	0·005	0·005	0·005
Mean difference irrespective of sign	0·0024	0·0030	0·0025	0·0027	0·0023	0·0016	0·0020
Residual difference (— Meteorological Office)	+0·0010	−0·0001	+0·0008	−0·0001	+0·0001	+0·0001	+0·0003
Mean monthly difference between simultaneous barograph and barometer readings	0·0015	0·0023	0·0018	0·0022	0·0023	0·0015	0·0016

THERMOGRAPH :—														
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		{1st half.—Bad. {2nd „ Good.		Fair.		Fair.		Do.		Fair.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	2 hrs.	2 hrs.	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ imperfectly moistened bulbs	—	0	—	0	—	8 hrs.	—	0	—	0	—	16 hrs.	—	0
„ „ partially frozen bulbs	—	0	—	0	—	0	—	0	—	0	—	0	—	0
„ „ other causes	0	0	0	0	0	0	0	0	0	‡1 hr.	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	1	0	0	0	0	0	1	0	1	0	0
„ „ by subsidiary measurements	0	0	0	0	0	0	0	1	1	3	0	0	0	0
„ „ of subtraction in do. tables	0	0	0	0	0	0	1	3	1	1	0	1	1	1
„ „ detected under glass scale	7	1	10	3	6	3	37	3	3	5	0	3	13	6
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·3	0·3	0·2	0·4	0·5	0·4	0·3	0·3	0·3	0·2	0·3	0·3	0·3
Mean difference irrespective of sign	0·11	0·10	0·12	0·10	0·15	0·09	0·21	0·07	0·11	0·13	0·08	0·11	0·11	0·11
Residual difference (— Meteorological Office)	−0·09	−0·07	−0·11	+0·02	+0·06	+0·06	+0·19	−0·03	−0·08	+0·09	+0·05	+0·03	−0·01	+0·01
Mean monthly difference between simultaneous thermograph and thermometer readings	0·20	0·27	0·14	0·19	0·10	0·12	0·21	0·23	0·15	0·26	0·12	0·18	0·23	0·23
No. of errors in maxima and minima	0	—	7	—	3	—	5	—	1	—	1	—	4	—

* Loss due to bad action of pencil. † Smoked chimney. ‡ Finger-mark on trace.

SUBMITTED—The following STATEMENT respecting the RECORDS for July 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
Action	Good.	Good.	Good.	Indifferent.	Good.	Good.	Good.	Good.	Good.	Good.	Indifferent.	Good.	Indifferent.	Good.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orientation verified	31st	—	30th	—	15th	—	5th	—	2nd	—	30th	—	14th	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	1	0	2	0	2	0	0	0	0	1	2
Result of 40 *Remeasurements*:—														
Greatest difference	0·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0	0·0	2·0	0·0	1·0	0·0	1·0
Mean difference irrespective of sign	0·0	0·3	0·0	0·5	0·1	0·4	0·0	0·4	0·0	0·5	0·0	0·4	0·0	0·4
Residual difference (—Meteorological Office)	0·0	0·0	0·0	0·0	−0·1	+0·1	0·0	+0·1	0·0	+0·1	0·0	+0·2	0·0	0·0
RAIN GAUGE:—														
Action	Indifferent.		Indifferent.		Bad.		Indifferent.		Indifferent.		Good.		Good.	
Records deficient, due to stoppage of clock	0		16 hrs.		8 hrs.		0		0		0		0	
„ „ other causes	*14 hrs.		0		0		0		†14 hrs.		0		0	
Errors in tabulation	0		4		0		3		2		4		0	

BAROGRAPH :—

Action - - - - - -	Good.	Indifferent.	Good.	Good.	Good.	Good.	Good.
Photography - - - - -	Do.	Good.	Do.	Do.	Do.	Do.	Do.
Records deficient, due to stoppage of clock -	0	‡27 hrs.	1 hr.	0	0	0	0
„ „ failure of light -	0	0	0	0	0	0	0
„ „ other causes - -	0	§1 hr.	0	0	0	0	0
No. of errors discovered—							
In entry of standard - - -	0	0	3	0	3	0	0
„ calculating residual correction -	0	0	0	2	1	0	0
„ applying residual correction - -	0	1	0	3	9	1	1
„ subtraction in subsidiary tables -	0	0	0	2	3	2	1
„ tabulation by subsidiaries - -	0	0	0	0	0	0	0
„ „ irregular differences -	0	0	3	0	0	5	0
Result of 40 *Remeasurements :—*							
Greatest difference - - - -	0·005	0·006	0·005	0·008	0·005	0·005	0·007
Mean difference irrespective of sign - -	0·0022	0·0024	0·0025	0·0024	0·0023	0·0023	0·0021
Residual difference (— Meteorological Office) -	−0·0007	+0·0010	−0·0002	+0·0006	−0·0012	−0·0003	−0·0007
Mean monthly difference between simultaneous barograph and barometer readings - -	0·0016	0·0025	0·0016	0·0017	0·0023	0·0013	0·0015

THERMOGRAPH :—

Action - - - - - -	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography - - - - -	Do.		Do.		Indifferent.		Do.		Do.		Do.		Do.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light -	0	0	0	0	0	0	0	0	1 hr.	0	0	0	0	0
„ „ imperfectly moistened bulbs - -	—	0	—	4 hrs.	—	25 hrs.	—	1 hr.	—	2 hrs.	—	3 hrs.	—	0
„ „ partially frozen bulbs -	—	0	—	0	—	0	—	0	—	0	—	0	—	0
„ „ other causes - -	‡4 hrs.	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard -	0	0	0	2	1	2	0	0	0	0	0	1	1	0
„ „ by subsidiary measurements -	0	0	0	0	0	0	0	0	0	1	1	0	0	0
„ „ of subtraction in do. tables -	0	0	0	1	0	1	0	1	0	4	1	2	0	1
„ „ detected under glass scale -	3	1	8	5	5	3	19	12	4	4	0	0	2	2
Result of 40 *Remeasurements :—*														
Greatest difference - - - -	0·2	0·3	0·4	0·2	0·3	0·3	0·4	0·4	0·3	0·2	0·2	0·2	0·2	0·3
Mean difference irrespective of sign - -	0·10	0·10	0·11	0·10	0·13	0·12	0·15	0·15	0·12	0·10	0·09	0·14	0·09	0·10
Residual difference (— Meteorological Office) -	−0·10	−0·08	−0·11	−0·03	+0·08	−0·08	+0·09	−0·14	−0·09	+0·08	+0·06	+0·10	−0·07	−0·09
Mean monthly difference between simultaneous thermograph and thermometer readings -	0·19	0·16	0·15	0·18	0·08	0·12	0·22	0·24	0·13	0·24	0·11	0·19	0·20	0·16
No. of errors in maxima and minima - -	2	—	7	—	5	—	5	—	3	—	0	—	1	—

* Bad action of pencil. † Funnel choked. ‡ Owing to bad action of light-stop. § Instrument under examination.

The Hydrographer reported that he recommended Navigating Lieutenant C. W. Baillie, late Director of Nautical Studies at the Imperial Naval College, Japan, for employment as assistant in the Marine Department (Minutes, p. 48.)

The following terms for the appointment were approved :—

1. The salary to be 200*l.* per annum.
2. The appointment and the taking up of official duties to commence on the 1st of October 1879.
3. The appointment to be for one year, subject to annual renewal. One quarter's notice of withdrawal required on either side.
4. The instructions to emanate from the Council and to be conveyed through the Marine Superintendent.
5. The duties to be confined to that branch of the Office which deals with Ocean Meteorology. The hours to be same as those of the Secretary and Marine Superintendent.
6. The vacation to be six weeks in the year.
7. The assistant will be expected to devote the whole of his office hours to the preparation of work which shall be the exclusive property of the Council.
8. He will receive the assistance of a writer over whom he will have entire control—subject to such general office regulations as may from time to time be in force.
9. A report of the work performed and in progress is to be prepared by the assistant and presented to the Council at the end of each quarter, commencing December 31st, 1879.

It was agreed that the first work assigned to Mr. Baillie should be the continuance and completion of the discussion of the sea temperature and currents of the Pacific Ocean, already commenced in the Office (Minutes, 1878, p. 106).

Mr. Baillie was introduced to the Council, and was appointed assistant in the Marine Department on the above terms.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting 55 logs had been received, 29 of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. A. E. Barlow	S.S. "Nizam" -	Jan 26—June 27, 1879.	Southampton, Bombay, Shanghai.	1878-9, p. 98.
Capt. W. Barron -	S.S. "Sultan" -	May 18—Sept. 11, 1879.	Hull and Hamburg, eight voyages.	1879, p. 19.
Capt. A. H. Blackie, R.N.R. (since deceased).	"Melpomene" -	Sept. 2—Dec. 29, 1879.	Liverpool to Rangoon -	1878, p. 49.
Capt. James Buchan	Barque "Commewyne."	April 26—Aug. 19, 1879.	Glasgow to Surinam and home.	1879, p. 7.
Capt. W. F. Caborne R.N.R., F.M.S.	S.S. "Oakdale"-	Feb. 27—July 24, 1879.	Cardiff, Aden, India, Mediterranean, Cronstadt, &c.	1878, p. 49.
Capt. H. W. Dyke -	Barque "Agnes Wilson."	Dec. 26, 1878—July 29, 1879.	Cardiff, Rio Janeiro, St. Thomas, Belize, and home to Goole.	—
Capt. W. Ellery -	Ship "Majestic"	Oct. 31, 1878—July 18, 1879.	Liverpool, Calcutta and back.	1878, p. 49.
Capt. H. v. Freeden	Brig "W. v. Freeden."	April 14—Aug. 27, 1879.	West Indies and Glasgow	—
Capt. T. W. Freeman	S.S. "Nestor" -	Dec. 1, 1878—June 8, 1879.	Liverpool, Shanghai, and home to Amsterdam.	1878, p. 71.
Capt. D. Gray -	S.S. "Eclipse" -	March 12—July 31, 1879.	Whaling in Arctic regions.	1878, p, 49.
Capt. J. Gray -	S.S. "Hope" -	Mar. 16—Aug. 20, 1879.	Do.	Do.
Capt. S. B. Gray -	Barque "Letterewe."	May 26, 1878—June 19, 1879.	Liverpool, Sydney, San Francisco, and home.	1877, p. 82.
Capt. J. G. Greig -	Ship "British Peer."	Sept. 8, 1878—July 11, 1879.	Liverpool, Calcutta, and home.	—
Capt. J. P. Holdich, R.N.R.	Barque "Overdale."	Jan. 28, 1878—June 20, 1879.	Dundee, Adelaide, Newcastle (N.S.W.), Yokohama, Manila, and home.	1877, p. 17.

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. W. P. Hughes	Ship "Royal Alexandra."	June 1, 1878—June 11, 1879.	Liverpool, Calcutta, New York and home.	—
Capt. G. Innes -	Barque "Sir John Lawrence."	Aug. 8, 1878—June 13, 1879.	London to Melbourne, and back.	1877, p. 71.
Capt. J. Kidder -	S.S. "Fleurs Castle"	Nov. 9, 1878—Aug. 15, 1879.	Cardiff, Singapore, China, and home.	1878, p. 49.
Capt. J. Metcalfe -	S.S. "Oceanic" -	July 11, 1878—Feb. 13, 1879.	Hong Kong, Yokohama, San Francisco and back.	—
Capt. W. Randall -	Ship "Iron Cross."	June 4, 1878—June 20, 1879.	Liverpool, Calcutta, New York, and home.	1877, p. 82.
Capt. C. T. Raymond	Ship "Theophane."	Aug. 30, 1878—Aug. 26, 1879.	Liverpool, Melbourne, India, and home.	1878, p. 49.
Capt. J. Seymour -	S.S. "Kangaroo"	April 10—Sept. 24, 1879.	London to Natal, Zanzibar, and home.	—
Capt. W. Scott -	Brig "Alliance"	Feb. 2—June 18, 1879.	Glasgow, Surinam, and home.	1878, p. 112.
Capt. J. H. Stiven -	Ship "Arethusa"	Nov. 18, 1878—Aug. 6, 1879.	Cardiff, New Zealand, London.	—
Capt. G. R. Stuart -	Ship "Oamaru"	Oct. 12, 1878—Aug. 1, 1879.	Glasgow, Otago, London	1878, p. 49.
Capt. W. Symington	S.S. "Hankow"	Mar. 11—July 31, 1879.	London, Hankow, and back.	1878, p. 122.
Capt. W. Waring -	S.S. "Gordon Castle."	Dec. 7, 1878—Sept. 14, 1879.	London, China, Japan, New York and home.	1878, p. 79.
Capt. W. Watson F.M.S.	S.S. "Algeria" -	Feb. 8—Aug. 23, 1879.	Between Liverpool and New York.	1878, p. 135.
Commander W. J. L. Wharton, R.N.	H.M.S. "Fawn."	May 1—Aug. 31, 1879.	Surveying in Sea of Marmora.	1879, p. 24.
Capt. H. P. Wight -	Ship "Taranaki."	Nov. 7, 1878—June 21, 1879.	Greenock, New Zealand and home.	1878–9, p. 9.

Mr. Scott was instructed to present the charts (O. 27) to Captains Dyke, von Freeden, Greig, Hughes, Metcalfe, Seymour, and Stiven, and to convey the best thanks of the Council to the other observers.

Submitted—Applications for storm warnings for St. Sennen and Cape Cornwall.—Granted.

Reported—That the Daily Weather Charts had been supplied to the Reverend James Pearson of Fleetwood, for use in his tidal investigations, Mr. Pearson undertaking to forward to the Office memoranda of his observations of the influence of weather on the tides.

Read—Letter 1748, from Messrs. Brodie, T. D. Bell, and Francis, asking for an increase of salary of 10*l.* apiece, instead of the sums respectively granted at last meeting (Minutes, p. 51).—Consideration postponed.

Reported—That as a trained engraver could not be found as assistant to Mr. Stodart (Minutes, p. 19), Charles Bracey had been appointed (July 28, 1879), at 8*s.* per week for eight hours' work daily.

Reported—That A. Woolston had been appointed to assist in the Pantagraph Room (Minutes, p, 38), at 10*s.* per week for eight hours' work daily.

Reported—That H. J. Stevens had been appointed telegraphist (Minutes, p. 39), from August 18, at 30*s.* per week for eight hours' work daily.

STATEMENT of WORK done in PANTAGRAPH ROOM.

The following statement shows the progress made during July, with the reproduction of the curves for 1879:

Copper Plates.—Seven plates have been engraved, Nos. 23–29, bringing the date up to May 25th 1879.

Zinc Plates have been pantagraphed as follows:—Barograms, 6 plates, Nos. 24 to 29 inclusive; Thermograms, 8 plates, Nos. 25 to 32 inclusive; Anemograms, 8 plates, Nos. 26 to 33, inclusive; Rain Curves, 7 plates, Nos. 24 to 30, inclusive; Vapour Tension, 9 plates, Nos. 23 to 31, inclusive.

Photographic Curves have been checked and ruled to Plate 30 for barograms, and Plate 32 for thermograms.

The tabulations for April and May have been checked, and the Remark sheets written; the work for the latter month was passed to the Computing Room on the 30th instant.

Mr. Allen's report is attached.

R. H. Scott, Esq., F.R.S., &c. R. H. CURTIS.

Examination Room, July 31, 1879.

On the 25th June, the date of my last report, "the examination of the returns from the two Irish stations for May" was nearly completed.

I have now to report the completion of the *May* work, the examination of the returns from Valencia and Armagh for *June*, and completion of the thermograms of the other stations for the same month.

R. H. Scott, Esq., M.A., F.R.S. (Signed) T. E. ALLEN.

September 30, 1879.

Since July 31, the usual vacation has been taken by the staff, and the report I have to make to-day represents therefore but little more than a month's work.

In the interval the instruments were thoroughly repaired by Mr. Beck. The new Pantagraph was this month brought into use, and a little delay was thus necessarily caused at the commencement.

The work now stands as follows:—

Seven Copper Plates have been engraved,—Nos 30–36, thus completing the first six months of the year 1879.

Zinc Plates.—Barograms, 7 plates, Nos. 30–36, inclusive; Thermograms, 4 plates, Nos. 33–36, inclusive; Anemograms, 5 plates, Nos. 34–38, inclusive; Rain Curves, 6 plates, Nos. 31–36, inclusive; Vapour Tension, 5 plates, Nos. 32–36, inclusive.

Photographic Curves have been ruled to Plate 38 for barograms, and Plate 36 for thermograms.

During the month some time was occupied in finding values for the Stonyhurst Thermogram Upper Zero lines, and also in obtaining new values for the zero lines of the Aberdeen Wet Bulb, where a shift seems to have occurred. Some measurements for Synchronous Observations which were omitted at Armagh and Aberdeen were also made here.

Mr. Stodart was occupied for two or three days on large Copper Plates for the Marine Room.

The June tabulations were received from Mr. Allen on September 1st, and after being checked and the Remark sheets written, were passed to the Computing Room on September 6th. The July work was received on the 26th instant, and is now being checked.

Mr. Allen's memorandum is attached.

I may mention that I have now 12 months' copper plates, (6 months of 1876 and 6 months of 1879) on hand awaiting the decision of the Council before sending them to the printer.

R. H. Scott, Esq., F.R.S. (Signed) R. H. CURTIS.

Examination Room, September 26, 1879.

IN the interval since the date of my last memorandum on the state of the work of this branch—the 24th July—Mr. Aldridge and myself have been absent on the annual vacation, Mr. Aldridge for 15½ days, and myself for 14 days; this has delayed the progress of the work, and in consequence I have now to report the completion of the work for July only.

Every exertion is now being made to overtake the arrears; and I hope by the corresponding date of next month to make a more favourable report.

(Signed) T. E. ALLEN.

STATEMENT of WORK done in MARINE ROOM during JULY 1879.

October 1879.

New Logs examined.—9 in number.

Winds for three Southern Cape Squares, tabulation, &c. making fair progress.

Sea Temperatures for three Southern Squares. During the greater part of the month one person was wholly employed grouping the sea temperatures under each degree Fahrenheit for each single-degree Square, but owing to computer's slow rate of working, very little progress has been made.

Cape Gale Tables.—Very little work has been done under this head.

Pacific Charts of Sea Temperature and Currents.—February charts. Plotted all data from Admiralty Remark Books; May charts. Plotted remainder of Meteorological Office Logs; May charts. Commenced Plotting Admiralty Remark Books.

Collection of Data in Indian Ocean.—Considerable progress made.

Various minor matters which can be seen by referring to Journal of Room.

CHARLES HARDING.

R. H. Scott, Esq.

STATEMENT of WORK done in MARINE ROOM during AUGUST, 1879.

October 1879.

New Logs examined.—17 in number.

Winds for three Southern Squares, tabulation, &c. steadily progressing. Selection for natural areas and working results for the same prior to drawing wind-roses.

Wind-Area Instrument.—Plate engraved for April, three Southern Squares; plate engraved for January, six Cape Squares.

Cape Gale Tables.—Roughly plotting January gales on charts, and grouping on six separate forms.

Pacific Charts of Sea Temperature and Currents.—May charts, plotting Admiralty Remark Books continued.

Collection of Data in Indian Ocean.—Considerable progress made with July to December, and February to June, Data Books ready for transmission to India.

Various other work of less amount which can be seen by referring to Journal of Room.

CHARLES HARDING.

R. H. Scott, Esq.

STATEMENT of WORK done in MARINE ROOM during SEPTEMBER 1879.

October 1879.

New Logs examined.—20 in number.

Winds for three Southern Cape Squares, tabulation, &c. nearly completed. Selection made for natural areas, and results worked for the same prior to drawing wind-roses.

Wind-Area Instrument.—Plate engraved for July, six Cape Squares; plate engraved for October, six Cape Squares.

Currents.—January and April for six Cape Squares, individual Currents charted.

Sea Surface Temperatures.—January and April for six Cape Squares grouped similarly to winds, and for similar areas, and under each degree Fahrenheit.

Cape Gale Tables.—January and July for six Cape Squares, results for each month grouped on *Six* forms separated into outward and homeward, and for each 10° of longitude.

Pacific Charts of Sea Temperature and Currents.—May charts completed.

Index of Data in Ocean 10° Squares.—Considerable progress made in posting up arrears.

Collection of Data in Indian Ocean.—The extraction of data for July to December nearly completed.

CHARLES HARDING.

R. H. Scott, Esq.

Reported—That the cash accounts for the quarter ended 31st March 1879 were audited by the Chairman and General Strachey on the 1st of August last, and had been sent to the Treasury for the Audit Office. The receipts for the quarter, exclusive of a balance of 1,080*l.* 5*s.* 2*d.* on the 1st January, amounted to 5,337*l.* 19*s.* 7*d.* The payments amounted to 4,690*l.* 19*s.* 8*d.*, leaving a balance of 1,727*l.* 5*s.* 1*d.* in hand and at the Bank on the 1st April 1879.

The following cheques for July were drawn on the 24th of that month :—

			£ s. d.
Administration :			
R. H. Scott, salary			66 13 4
Special Researches :			
E. I. Strachan, Arctic work	3 0 0		
Hopkins & Williams, oil for Scilly	0 13 10		
Postmaster General, wire to Queen Anne's Mansions	9 0 0		
J. J. Hicks, instruments	34 5 0		
G. M. Whipple, verifications	5 10 0		
„ various	0 17 5		
			53 6 3
Office Expenses :			
J. S. Harding, jun. } Salaries and wages	27 15 6		
T. D. Bell }	14 8 10		
J. S. Harding, sen. }	8 19 8		
			51 4 0
Baynes & Co., coals			8 8 0
Land Meteorology :			
W. L. Fox	8 10 0		
F. Figg, " Pagoda " observations	2 18 9		
G. M. Whipple, postage, &c.	1 1 7		
J. E. Cullum (Valentia), salary	18 6 8		
J. J. Hicks, instruments	2 2 0		
			32 19 0
Carried forward			212 10 7

		£ s. d.	£ s. d.
	Brought forward -	- -	212 10 7
Land Meteorology—*cont.*			
R. H. Curtis -	Discussion, &c. of observations	32 4 5	
J. A. Curtis -		15 11 1	
T. E. Allen -		15 11 1	
C. H. Thompson		*9 4 0	
E. G. Aldridge -		*7 6 8	
			79 17 3
H. N. Cobley -	Ditto ditto	†8 8 0	
A. J. Rigby -		†11 4 0	
C. Stodart -		†8 8 0	
			28 0 0
Weather Telegraphy:			
Postmaster, Stornoway, telegrams - -		1 7 0	
G. M. Whipple, inspectors - - -		2 2 0	
J. S. Harding, drawback - - -		0 5 0	
			3 14 0
F. Dangerfield, delivery of Daily Weather Charts		- -	12 2 7
F. Gaster -	Preparation, &c. of Weather Reports.	35 4 10	
W. L. Dallas -		19 15 1	
F. Brodie -		22 0 0	
H. Chivers -		*6 12 0	
			83 11 11
R. Sargeant	ditto ditto		‡7 1 9
Ocean Meteorology:			
G. M. Whipple, "B. T." verifications - -		5 11 0	
„ "A." „ - -		13 10 0	
J. J. Hicks, "B. T." instruments - -		1 16 0	
L. P. Casella, "A." „ - -		28 16 0	
E. P. Edwards, advertisement - - -		1 2 6	
			50 15 6
Captain H. Toynbee	Reduction, &c. of Observations and care of instruments.	33 6 8	
R. Strachan -		27 15 6	
C. Harding -		28 17 9	
H. Harries -		*11 4 0	
			101 3 11
R. Mustart - - - - -		- -	3 3 0
Miscellaneous:			
Pickford & Co., carriages - - -		1 15 0	
„ „ - - -		1 0 10	
J. J. Hicks, commissions - - -		1 15 0	
G. M. Whipple „ - - -		3 15 0	
			8 5 10
J. S. Harding, jun., petty cash - - -		- -	100 0 0
„ „ - - -		- -	150 0 0
R. H. Scott, on account - - -		- -	30 0 0
	Total	- -	£870 6 4
On the 20th August:			
F. Barry, lease of his rooms - - -		- -	150 0 0

* Four weeks to 26th July.
† Four weeks to 30th August.
‡ Three weeks ending 12th July.

The following cheques for August were drawn on the 25th of that month :—

		£ s. d.	£ s. d.
Administration :			
R. H. Scott, salary		- -	66 13 4
J. S. Harding, jun.	Salaries and wages	27 15 6	
J. S. Harding, sen.		*11 4 7	
T. D. Bell		12 15 6	
			51 15 7
Land Meteorology :			
R. & J. Beck, zinc plates		- -	26 5 4
J. E. Cullum, salary		- -	15 16 8
R. H. Curtis	Reduction, &c. of Observations	22 4 5	
J. A. Curtis		15 11 1	
T. E. Allen		15 11 1	
C. H. Thompson		*11 10 0	
E. G. Aldridge		*9 3 4	
			73 19 11
Weather Telegraphy :			
H.M. Postmaster General, May		197 5 8	
,, June		172 4 4	
			369 10 0
F. Gaster	Preparation, &c. of Weather Reports.	32 19 6	
W. L. Dallas		18 18 1	
F. Brodie		17 17 8	
H. W. Chivers		*8 5 0	
			78 0 3
G. Sellar, preparation of rainfall statistics		- -	6 1 10
J. Spencer, ,, ,,		- -	6 1 10
Ocean Meteorology :			
Imperial Ottoman Bank, re-purchase of Instruments from Cyprus			47 12 0
Negretti & Zambra, "A." instruments		23 6 0	
,, "B. T." ,,		37 7 0	
			60 13 0
Elliott Brothers, protractor		- -	2 2 0
J. R. Jones, Aberdeen agent		- -	1 11 7
H. J. Thatcher, Cardiff ,,		- -	7 9 3
P. A. Feathers, Dundee ,,		- -	3 15 0
J. Gill, Liverpool agent		- -	14 2 5
King, Seymour, & Co., So'ton agent		- -	12 7 6
Captain H. Toynbee		33 6 8	
R. Strachan	Reduction, &c. of observations and care of instruments.	27 15 6	
C. Harding		22 4 5	
H. Harries		*14 0 0	
			97 6 7
R. Mustart, extraction of observations		- -	4 2 3
Miscellaneous :			
F. Pastorelli, International Meteorology		- -	16 0 0
Negretti & Zambra, commissions		- -	32 13 7
J. S. Harding, jun., petty cash		- -	100 0 0
,, ,,		- -	100 0 0
			£1,193 19 11

The following cheques for September were drawn on the 29th September :—

	£ s. d.
Administration :	
R. H. Scott, salary	66 13 4
J. S. Harding, Council on account	6 15 9
Special Researches :	
D. Currie & Co., freight of barometers sent to Cape Observatory	1 3 8
N. Hoffmeyer, synoptic charts	14 15 3
R. W. Munro, forms, &c. for Scilly anemometer	3 3 10
W. Thomas, care of do.	1 12 6
Carried forward	£94 4 4

* Five weeks ending 30th August.

	£ s. d.	£ s. d.
Brought forward -	- -	94 4 4
Office Expenses:		
J. S. Harding, jun. }	27 15 6	
T. D. Bell - - } Salaries and wages -	12 15 6	
J. S. Harding, sen. }	*8 19 8	
		49 10 8
C. W. Jacques, rent at No. 116 - -	133 13 0	
„ „ No. 113 (half-quarter) -	9 0 3	
		142 13 3
Atkinson & Co., furniture - - -	- -	29 18 0
H. Bond & Son, hire of furniture (India Office work) - - -	6 17 6	
„ Alterations and fittings in Office	59 13 0	
		66 10 6
E. Higgs „ „	- -	13 15 0
Land Meteorology (Quarterly Allowances, &c.):		
D. Thomson, Aberdeen - - - -	- -	69 7 0
T. R. Robinson, Armagh - - -	46 19 0	
„ (expenses) - - -	8 13 6	
		55 12 6
W. L. Fox, Falmouth - - - -	- -	71 9 0
R. Grant, Glasgow - - - -	- -	67 14 0
H. Williams, Holyhead - - -	- -	2 13 5
G. M. Whipple, Kew - - - -	100 0 0	
„ waxed paper - -	19 0 0	
„ postages, &c. - -	0 14 0	
		119 14 0
C. Clouston, Orkney - - - -	- -	2 10 0
G. H. Aird, Seaham - - - -	- -	2 13 10
S. J. Perry, Stonyhurst - - -	- -	55 4 0
J. E. Cullum, salary - - - -	15 16 8	
„ (expenses) - - -	50 12 5	
		66 9 1
W. Marriott, Meteorological Society's Returns	- -	25 0 0
G. T. Watson, Yarmouth - - -	- -	4 0 0
R. & J. Beck, cleaning pantagraphs - -	- -	10 14 6
R. W. Munro, repairs to S. R. instruments -	- -	1 5 0
R. H. Curtis - }	22 4 5	
J. A. Curtis - }	15 11 1	
T. E. Allen - } Reduction, &c. of Observations	15 11 1	
C. H. Thompson - }	*9 4 0	
E. G. Aldridge - }	*7 6 8	
		69 17 3
Weather Telegraphy (Quarterly Allowances, &c.):		
G. Carrick, Ardrossan - - - -	- -	1 3 3
Postmaster, Bundoran - - - -	- -	0 13 0
H. Todd, Cambridge - - - -	- -	4 11 3
Postmaster, Cliffony - - - -	- -	0 13 0
J. MacGowan, jun., Donaghadee - -	- -	0 13 0
J. Costello, Dover - - - -	- -	4 4 0
W. Brand, Dunrossness - - -	- -	4 8 0
Postmaster, Enniskillen - - -	- -	0 13 0
J. Tilston, Holyhead - - - -	- -	3 18 0
T. Lanceley, Hurst Castle - - -	- -	3 19 6
A. P. Hay, Inverness - - - -	- -	1 6 0
J. Fisher, Jersey - - - -	- -	4 5 6
T. Curtayne, Killarney - - -	- -	0 13 0
Carried forward -	-	£1,051 15 10

* Four weeks to the 29th September.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	1,051	15	10
Weather Telegraphy (Quarterly Allowances, &c.)—*cont.*						
G. Mitchell, Kingstown - - -	-		-	3	18	9
P. Turnbull, Leith - - - -	-		-	0	13	0
F. Gaster, London - - - -	-		-	3	18	0
H.M. Postmaster General, o/a, K. Kerr -	3	18	9			
„ „ Conway -	5	17	0			
				9	15	9
W. D. Penny, Nairn - - - -	-		-	4	4	6
M. Mackintosh, Nairn - - -	-		-	0	13	0
J. W. Irvine, N. Shields - - -	-		-	0	10	0
E. J. Lowe, Notts - - - -	-		-	3	18	0
J. E. Bellamy, Oxford - - -	-		-	3	11	6
G. Blackler, Prawle Point - - -	-		-	3	10	0
J. C. Walker, St. Ann's Head - - -	-		-	0	12	0
W. Thomas, Scilly - - - -	-		-	4	17	6
R. W. Scaddard, Scilly - - -	-		-	0	13	0
J. H. Watson, Spurn Head (June quarter) -	-		-	1	17	3
J. Sutherland, Stornoway - - -	-		-	7	8	5
W. Morison „ - - -	-		-	1	6	0
J. Sinclair, Wick - - - -	-		-	3	5	0
J. Murray „ - - - -	-		-	1	7	0
G. T. Watson, Yarmouth - - -	-		-	4	1	6
Yorkshire Philosophical Society, reports -	-		-	4	0	6
Postmaster General, July - - -	201	19	11			
„ Valencia wire - -	23	10	0			
				225	9	11
Wightman & Co., B.P. wrappers, &c. - -	3	11	3			
„ Forecasts - - -	4	9	6			
				8	0	9
Hopkinson & Co., printing press - -	-		-	45	12	0
F. Gaster -	31	13	6			
W. L. Dallas - Preparation, &c. of Weather	18	18	1			
F. Brodie - Reports.	19	9	8			
H. W. Chivers	*6	12	0			
				76	13	3
Inspections:						
A. Buchan, salary - - - -	37	10	0			
„ expenses - - - -	36	3	1			
				73	13	1
W. C. Ley, salary - - - -	37	10	0			
„ expenses - - - -	46	16	3			
				84	6	3
G. M. Whipple „ - - - -	-		-	29	10	0
For Ocean Meteorology:						
P. Adie, repairing "A." instruments - -	19	2	6			
„ „ "B.T." „ - -	13	10	0			
				32	12	6
D. Currie, freight to Cape dockyard - -	-		-	1	3	8
G. M. Whipple, verifications "A." account -	7	5	0			
„ „ "B.T." „ -	10	6	0			
				17	11	0
D. MacGregor & Co., Glasgow agents - -	-		-	3	6	9
J. H. Woodstock, packing cases - -	-		-	2	13	6
Crown agents, Bermuda anemometer - -	2	5	1			
„ „ - -	2	9	6			
				4	14	7
Carried forward -				£1,721	3	9

* Four weeks to the 29th September.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	1,721	3	9
For Ocean Meteorology—*cont.*						
W. Allingham, observations for India Office -	7	8	4			
" " -	10	0	0			
				17	8	4
C. Harding " - -	7	10	0			
" " - -	10	0	0			
				17	10	0
Capt. H. Toynbee — Discussion, &c. of observations	33	6	8			
R. Strachan - — Discussion, &c. of observations	27	15	6			
C. Harding - — Discussion, &c. of observations	22	4	5			
H. Harries - — Discussion, &c. of observations	*11	4	0			
				94	10	7
Miscellaneous :						
J. S. Harding, jun., translation of report of Congress -			-	7	16	6
" petty cash, on account -		-	-	100	0	0
" " -		-	-	100	0	0
				£2,058	9	2

* Four weeks ending 27th September.

The Council then adjourned until Wednesday, October 15, at 2 p.m.

116, *Victoria Street, October* 15, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. GALTON.	PROFESSOR STOKES.
GENERAL STRACHEY.	THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (October 4) were read and confirmed.

The Chairman submitted the following draft reply to the Colonial Office (Minutes, p. 52), which was approved:—

SIR,

IN reply to your letter of September 11, I am requested by the Meteorological Council to state that the salaries suggested by them for the staff proposed to be employed on meteorological observations in Antigua are the lowest at which the Council believe it would be possible to secure the services of competent persons, supposing such persons to be engaged here and sent out to the West Indies.

The Council, however, can quite understand that there may be local circumstances rendering it possible to entrust the duties in question to persons already resident on the spot, and in this case the salaries might in all probability be very considerably reduced.

The Council therefore venture to recommend that the plan proposed by them, with the explanation now given, should be submitted to the Colonial Governors. If any more economical way of effecting the objects in view should be suggested, the Council would be willing to express an opinion as to its probable efficiency.

Although the Council are advised that the island of Antigua is the most favourably situated of the West Indian Islands for the purposes of a central meteorological station, this advantage might be outweighed, particularly in making a first attempt to establish the system, by greater local facilities, should such exist, for obtaining the requisite staff in some other island.

I may, in conclusion, be allowed to remind you that the plan submitted by the Council was in lieu of a much more costly proposal which had been brought under the notice of the Colonial Office.

Yours, &c.,

(Signed) ROBERT H. SCOTT,
Secretary.

The Chairman submitted the following correspondence in relation to General Myer's request for the co-operation of the British Navy in the system of simultaneous observations at 0h. 43m. Greenwich mean time (Minutes, p. 46), &c. :—

SIR, Meteorological Office, August 1879.

THE Council of the Meteorological Office desire to obtain a series of synchronous observations taken daily at 0h. 43m. Greenwich mean time, and at as many different places on the surface of the globe as may be practicable.

The object which the Council have in view would be greatly furthered if such observations could be taken on the ships of Her Majesty's Navy. They venture, therefore, to request the Admiralty to consider the advisability of directing these observations to be regularly taken, and to be transmitted at such intervals as may be convenient.

Forms for the entry of synchronous observations are at present inserted in the Meteorological Log, which is kept by the storekeeper at each of Her Majesty's Dockyards for supply, if demanded, together with the usual establishment of meteorological instruments to Her Majesty's ships in commission, but as these observations are now only optional, they are not generally taken.

It may be proper to mention that the meteorological institutes of several foreign countries are interested in the system of synchronous observations, and that, in particular, the Chief Signal Office of the United States has expressed a desire to receive copies of all such observations which the Meteorological Office may be able to obtain.

I am, &c.

The Secretary of the Admiralty. (Signed) HENRY J. S. SMITH, Chairman of the Council of the Meteorological Office.

M.O. 2511.

SIR, Admiralty, October 10, 1879.

WITH reference to your letter of the August, requesting that synchronous meteorological observations may be taken daily at 0h. 43m. Greenwich mean time on board Her Majesty's ships on foreign stations and recorded, I am commanded by my Lords Commissioners of the Admiralty to acquaint you, for the information of the Council of the Meteorological Office, that my Lords are prepared to entertain the request contained in your letter.

2. I am to add that their Lordships would propose to leave to the consideration of the Council the preparation of the detailed instructions as to the observations required, the preparation of the necessary forms to be filled up, together with any other matters of detail desirable to secure the object in view, observing that the periods at which the recorded observations should be transmitted to England should be stated.

3. On the receipt of the above-named particulars their Lordships will be prepared to issue the necessary orders to the Fleet.

I am, &c.

The Chairman of the Meteorological Council. (Signed) THOS. WOLLEY.

The Secretary was instructed to prepare a form for the record of such observations, and submit it to the Council.

Mr. Galton submitted a memorandum on a proposed form of sea thermometer rose (Minutes, p. 60) Letter 2,628, which was ordered to be copied and circulated among the members of Council, and he undertook to consider the possibility of obtaining homogeneous areas for sea temperature.

Captain Toynbee attended, and a form for current and temperature charts proposed by him for the Cape squares (Letter 2,543) was considered.

The Current Chart for July was submitted, and it was resolved that it should be lithographed.

The Secretary submitted the following report of his inspections in Ireland and Wales :—

REPORT on the INSPECTION of the IRISH and WELSH STATIONS.

GENTLEMEN, October 15, 1879.

I HAVE to report the completion of my inspection of the Irish and Welsh stations, which I shall deal with in chronological order, treating firstly of the telegraphic reporting stations, then of the stations of the second order, and lastly of the observatories.

TELEGRAPHIC STATIONS.

Holyhead, visited August 14.—This station was in good order, and the instruments were correct. It is unfortunate that there is apparently no possibility of finding a substitute who can take the observer's place in case of illness, &c. The observer is old, and his reports of wind are not quite satisfactory as regards force.

Kingstown, visited August 15.—This station was in very good order, and the instruments were correct. The thermometer screen is now erected in an open space attached to the harbour-master's office, which affords an excellent exposure.

As regards wind reports we find that the direction and force experienced within Dublin Bay differ materially from those prevailing in the offing. This matter is so serious that I am disposed to recommend that Kingstown be suppressed as a reporting station, and that Birr Castle be adopted instead. We should thereby gain daily information as to the weather in the interior of Ireland which we do not at present receive. The observer at Kingstown does not object, and Lord Rosse would gladly allow his meteorological observer to undertake the duty.

Donaghadee, visited August 18.—This station does not call for any very special remark. There is not a very good situation for a free-standing screen for the thermometers, but if the Council think it desirable for the sake of uniformity to erect a Stevenson's screen, one could be supplied. The rain-gauge has been moved to a more open situation than it occupied at the time of Mr. Whipple's visit in 1878.

Mullaghmore, visited August 20.—This station is in a most satisfactory condition, as it affords a very good exposure for wind on all sides, and for sea from all points from S.W. to N. The observer, Chief Boatman Kerr, has a very efficient assistant in his daughter. The only difficulty is as regards the conveyance of the messages to the postal telegraph office at Cliffoney, a distance of about three miles; the messages are now sent by a boy. If it should be found that the rental of a private wire would not much exceed the wages of the messenger, I would recommend the Council to complete the telegraphic communication.

Roche's Point, visited August 26.—This station was in a much more satisfactory condition than when Mr. Whipple visited it last year. I should recommend that a Stevenson's screen be supplied, as the wall screens now employed are placed very close to the entrance door, and may be unduly heated.

Valencia, visited September 6.—This station is in very good order, but the difficulty of obtaining good reports of sea disturbance, or any trustworthy wind reports on that very mountainous part of the coast, is very great.

St. Ann's Head, visited September 25.—This station was, as usual, in perfect order. Mr. Walker is one of the best reporters we have.

Stations of the Second Order.

Dublin, visited August 15.—Dr. J. W. Moore, the observer, has the instruments at his house, No. 40, Fitzwilliam Square. His thermometer screen and rain-gauge are in his garden, which is very small, and does not give a good exposure, but this can hardly be obviated in a large city.

Mountjoy Observatory, visited August 16.—This station has been thoroughly reorganised since the date of Mr. Whipple's inspection in 1878, the instruments lent by the Council (Minutes, 1878, p. 98) being now in use. Col. C. W. Martin, R.E., formerly at Chatham, has succeeded Col. Wilson as Superintendent of the Irish Ordnance Survey, and he will no doubt use the same energy in organising these observations as he has already evinced.

His thermometer screen and rain-guage are in an open field, in a slight wire inclosure, and he has a scaffolding 40 feet in height, on which he is ready to institute experiments on the effect of height on thermometer readings, &c.

Colebrooke, visited August 19.—The observer here is Sir Victor Brooke's gardener. The instruments are well placed, but there is no hope of obtaining a good exposure for the wind, as the demesne is thickly wooded.

Markree, visited August 21.—This station is in a fairly satisfactory state, but Dr. Doberck, the chief of the observatory, takes no interest in the meteorological observations, and since his sister's return to Copenhagen, the observations have been taken by Mrs. Salles, his housekeeper, who is very attentive and careful. There is a difficulty in getting the observations reduced.

Mount Trenchard, Foynes, visited August 27.—This station has been recently established by Lord Monteagle. It is on a promontory on the south bank of the Shannon, which is about one mile in width at the place. The country is very uneven, so that the winds will not be correct, having a tendency to blow along the river valley. Lord Monteagle has as yet no barometer, and only proposes to supply observations for the Weekly Weather Report and to the Irish Registrar General for his returns. The observer, Mr. Carey, seems very capable. The thermometer screens and rain-gauge are well exposed on a hill above the house.

Birr Castle, visited September 15.—This station was in very good order. Mr. Harding, a clerk in the Agency Office, being the observer.

I have already stated that I recommend that Parsonstown be made a telegraphic reporting station in place of Kingstown, and I am glad to say that Lord Rosse offers no objection to the proposal.

St. David's, visited September 24.—This station was in very good order. Dr. Propert is assisted by his son, and the record is well kept.

I append a tabular statement of the comparisons, after instrumental errors have been applied.

Armagh Observatory, visited August 18.—This station calls for no remark, except that Mr. Call has to discharge the duties single-handed, which is in many respects undesirable.

Valencia Observatory, visited September 6.—I regret to say that it will be necessary to have some repairs done at this observatory. The house is in serious want of painting, &c., both inside and outside. The kitchen range required repairs, which I have ordered to be effected, as well as some minor matters.

Robert H. Scott.

COMPARISON of the INSPECTOR'S STANDARD THERMOMETER with the STATION THERMOMETERS in WATER, 1879.

STATIONS.	Inspector's Thermometer.	Dry Bulb.	Wet Bulb.	Spare.	Max.	Min.	Extra Spare.
St. Ann's Head -	53·3	+0·7	+0·5	+0·4	+0·1	+0·4	—
Roche's Point - -	56·2	+0·8	+0·5	—	−0·2	−0·2	—
Valentia - -	58·8	+0·4	+0·8	+0·9	+0·2	+0·2	—
Mullaghmore - -	63·8	−0·1	−0·2	0·0	+0·2	−0·4	−0·1
Donaghadee - -	58·0	+0·1	0·0	+0·2	+0·5	0·0	—
Kingstown - -	60·8	+0·2	+0·1	—	−0·1	0·0	—
Holyhead - -	60·6	+0·5	+0·2	−0·5	−0·1	−0·6	—
Dublin - -	Thermometers rusted to frame.						
Mountjoy Observatory -	Thermometers very recently supplied.						
Colebrooke - -	67·9	+0·8	+0·8	—	0·0	+0·7	
Markree - -	57·6	0·0	+0·5		0·0	+0·2	
Mount Trenchard -	Instruments erected by Inspector.						
Birr Castle - -	56·2	+0·3	+0·4	+0·5	−0·2	0·0	−0·2
St. David's - -	49·0	0·0	+0·1	—	+0·2	0·0	

Submitted—The following statement of accounts for the six months ending 30th September 1879:—

INCOME.

	£	s.	d.	£	s.	d.
Balance from year 1878–9 -				709	9	10
Vote for year 1879–80:						
Amount paid -	6,750	0	0			
„ unpaid -	7,750	0	0			
				14,500	0	0
SUPPLY OF INFORMATION:—						
Preparation of weather reports for newspapers, &c. - - -				289	19	6
Repayments for telegrams, subscriptions for Daily Weather Charts, &c. - - - - -				423	5	4
Subscriptions for 11h. a.m. and 4h. p.m. forecasts and inquiries -				62	4	6
Ocean statistics - - -				253	5	5
Miscellaneous data - - -				0	16	6
SALE OF INSTRUMENTS, &c.:						
Royal Navy account - -				31	0	6
Mercantile Marine account -				45	8	3
Repayments of expenses charged under:—						
(1.) Incidental expenses -				9	9	5
(2.) Observatories, &c. -				6	12	0
(3.) Researches (Hoffmeyer's charts) - - -				5	0	0
Commission on work for Colonies, &c. - - - - -				5	18	3
				£16,342	9	6

EXPENDITURE.

	£	s.	d.
Council - - - -	500	0	0
Secretary - - - -	400	0	0
Special researches and experiments* -	76	18	9
Salaries and wages (Office expenses) -	353	4	9
Rent, fuel, and lighting† - -	438	6	4
Incidental and contingent expenses‡ -	263	4	7
New furniture - - -	32	11	0
Observatories and other stations -	1,224	6	5
Discussion and reduction of observations (land) - - -	704	0	10
Telegrams, storm warnings, and reporters§ - - - -	1,531	6	6
Preparation, issue, and discussion of Weather Reports - - -	711	13	11
Weather Forecasts‖ - - -	165	10	7
Inspections (salaries) - -	150	0	0
„ (expenses) - -	145	3	7
Royal Navy: supply of instruments -	141	15	3
„ other expenses -	2	5	2
Mercantile Marine: supply of instruments -	248	11	8
„ other expenses¶ -	164	17	1
Distant stations - - -	16	7	7
Reduction and discussion of observations (ocean) and care of instruments** - - - -	1,096	15	11
International meteorology - -	104	8	1
Balance - - - -	7,871	1	6
	£16,342	9	6

LIABILITIES.

	£	s.	d.
To Post Office (partly estimated) -	480	5	0
„ sundry creditors - - -	519	11	8
„ „ (contracts or work uncompleted) - - - - -	475	18	0
„ Council - - - -	493	4	3
„ balance - - - -	7,871	1	6
	£9,840	0	5

ASSETS.

	£	s.	d.
By cash at bank - - -	1,327	2	3
„ „ at Office - - -	287	7	8
„ „ at Valencia - - -	50	0	0
„ sundry debtors - - -	425	10	6
„ H.M. Exchequer - - -	7,750	0	0
	£9,840	0	5

* Eventual payments to Messrs. Abercromby, Ley, and Shaw, not yet included.
† Includes interest in lease of rooms at No. 113.
‡ „ alterations in various rooms and some fittings.
§ „ extra 2h. and 6h. p.m. observations, and some foreign reports.
‖ „ "Minerva" printing press and hay harvest forecasts.
¶ „ wind area instrument and alterations, copper-plates, and special charts for marine work, &c.
** „ payment of staff employed on observations for the India Office.

With reference to meteorological observations made in balloons (Minutes, p. 44), the Secretary reported that he was informed that no observations of scientific importance had been made with the captive balloon in Paris. He had also made inquiries at Chatham, and had learnt that no meteorological observations had been made by any of the officers experimenting with balloons in this country.

Reported—That the issue of forecasts to persons interested in the hay-harvest had been continued for a month, or in some cases six weeks (Minutes, p. 33), and that an analysis of the results will be submitted as soon as the reports of their success or failure are received.

Reported that a "Minerva" press had been procured for printing the forecasts in the Office, at a cost of 45*l.* 12*s.*, and that the cost of attendance of two men daily to work it would be 1*l.* 13*s.* 6*d.* per week (Minutes, p. 33).—Approved.

The Secretary reported that in accordance with the instructions given by Council (Minutes, p. 21), the Chairman and himself had an interview with the Postmaster General on the 17th of July.

At this interview they explained to Lord John Manners that the Office had to make three requests:—

i. That no alteration, such as that proposed in Mr. Patey's letter of April 16 (Minutes, p. 2), should be made in the existing scale of charges for foreign telegrams.

ii. That all messages on meteorological business should be transmitted at press rates, and not merely the 8 a.m. reports.

iii. That storm warnings (the cost of which in the past 12 months had been 428*l.*) should, if possible, be transmitted free of charge.

His Lordship promised to consider these three requests, and to forward his reply to the Office. On the 7th of August the following reply was received:—

M.O. 1956.

SIR, General Post Office, London, August 7, 1879.

WITH reference to the interview which the Chairman of the Meteorological Council and yourself had with the Postmaster General on the 17th ultimo, I am directed by his Lordship to inform you that he is unable to entertain favourably your application to be permitted to send meteorological telegrams at reduced rates; and further, that, as regards the changes to be made for the transmission of meteorological telegrams to and from foreign countries, he feels constrained to decide that the course described in the letter sent to you on the 16th April last must be followed.

I may add, however, that the new arrangement will not be brought into force until the 1st April, 1880.

I am, &c.

The Secretary, (Signed) JOHN TILLEY.
Meteorological Council.

The Secretary stated that on the 1st instant he had an interview with Mr. Patey on the subject, and received a promise that the question of the cost of foreign telegrams should be reconsidered.

He was instructed to prepare a reply to Mr. Patey's letter (No. 1926).

Reported—That the averages for 15 years of temperature and rainfall for use in the Quarterly Summaries of the Weekly Weather Report (Minutes, p. 46) had been completed.

Submitted—Applications for fishery barometers for the Coastguard Stations at Barna, co. Galway, and Portnoo, co. Donegal.—Granted.

Reported—That the Harmonic Analyser was reported by Mr. Munro to be complete.

The Secretary was instructed to send Mr. R. Curtis to Mr. Munro's workshop to test the working of the instrument before it was sent home.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting two logs had been received, one of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. G. H. Jones -	S.S. "Odessa" -	April 11—Oct. 2, 1879.	London to various European ports.	1878, p. 109.

Mr. Scott was instructed to convey the best thanks of the Council to Captain Jones.

Submitted—The English edition of the Report of the Meteorological Congress at Rome, Minutes, p. 1. (In proof.)

The meeting was then adjourned to the 29th inst., at 2 p.m.

116, *Victoria Street, October* 29, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of last meeting (October 15) were read and confirmed.

Reported—That a letter had been sent to the Colonial Office, as directed at last meeting.

Mr. Galton submitted a specimen of an attempt he had made to discuss the sea temperatures for the Cape Squares (Minutes, p. 69); the Chart employed was that for July, with the noon observations only plotted.

Resolved—That the Sea Temperatures (for noon only) be plotted for the months of January, April, and October, and that the four Charts be lithographed, commencing with the Chart for January.

Submitted—The lithographed Current Chart of the Cape Squares for July, as directed at last meeting.

Resolved—That Current Charts for the three months, January, April, and October, be lithographed, and that current lines be drawn on these Charts.

Professor Stokes submitted a stand for the sunshine recorder, prepared by Mr. Lecky under his direction (Minutes, 1878, p. 119). The stand was approved of, and it was resolved that 20 similar stands should be ordered, to be employed at stations in the British Isles, with the 20 glass spheres ordered in February last (Minutes, *l. c.*). The Secretary was instructed to submit a map showing the stations proposed to be supplied with these instruments.

Mr. De La Rue undertook to describe to Mr. Lecky a method for cutting the cards.

The Secretary reported that the extraction of the data for the India Office had been completed on the 25th instant, and that Mr. Bevan had been set free to work under Mr. Baillie. All that now remained to be done was to make the second copy of the data.

The Secretary was instructed to submit to the Council an account of the total cost of the work.

The Secretary reported that a Conference had been held at Hamburg at the beginning of the current month on the subject of M. Weyprecht's proposal to organize a series of Circumpolar Meteorological and Magnetic Stations, to be maintained for one year, and that as soon as he should receive a printed copy of the proceedings at the Conference, he would submit it to the Council.

Mr. De La Rue reported that he had recently visited the stations at Christiania, Gothenburg, Upsala, Copenhagen, and Hamburg. He had procured two of M. Hagemann's anemometers (described in the Danish Aarbog for 1876), and he presented them to the Office, stating that a paper by M. Hagemann, on his instrument, was to appear in the forthcoming part of the Quarterly Journal of the Meteorological Society.

Resolved—That the instruments be tested at Kew.

Mr. De La Rue also submitted specimens of cloud photographs, taken by Professor Hildebrandsson at Upsala, and stated that at that observatory Theorell's meteorograph was employed, and that it had worked perfectly since it was first erected, more than eight years ago (*vide* Minutes, 1878, p. 23).

The Secretary reported that he had obtained leave from the manager of Queen Anne's Mansions to connect the large anemometer on the building with the Office (Minutes, p. 44).

Read—A memorandum from Captain Toynbee reporting that since the last meeting seven logs had been received, four of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. R. Chitham	S.S. "Torrington."	June 8—Oct. 7, 1879.	Southampton to Batavia and Rotterdam.	1879, p. 7.
Capt. J. M'Donald Gray.	Barque "Shun Lee."	Nov. 17, 1878—Oct. 18, 1879.	London, Algoa Bay, Valparaiso, and Falmouth.	1878, p. 49.
Capt. H. Manning	S.S. "Seine"	Mar. 20—Oct, 13, 1879.	London to Mozambique, &c. (cable laying).	1871, p. 47.
Capt. J. Racburn, R.N.R.	"Lochee"	Feb. 21—Oct. 23, 1879.	Liverpool, Calcutta, and home.	1878, p. 112.

Mr. Scott was instructed to convey the best thanks of the Council to the respective observers.

Submitted—The following Report of the inspection of self-recording Observatories, 1879.

Falmouth Observatory, visited August 20th–23rd.—The interior of the building has been whitened and painted since last inspection.

The barograph and thermograph were in good order, and only needed to have their lenses cleaned and clocks oiled, which was done. I also improved the burning of the gas jets, which were not giving satisfactory light.

The anemograph was cleaned and oiled in my presence. One fan being very loose on its spindle, I packed the fitting with sheet lead to tighten it.

Finding the velocity pencil slightly overlapped the limiting lines on the curve, I reduced its length, but the operation has had the effect of slightly blurring the trace at one end; this blurr, however, will disappear as the pencil wears down.

The Beckley rain-gauge was in excellent order and not sheltered by plants.

Mr. Squire complains of the great difficulty he experiences in setting the pencil daily to the zero point; and requests that he may be furnished with a pencil holder having the pencil attached to an adjusting screw, so that he may be able to place it readily in its proper position.

The daily re-adjustment of the pencil in this instrument is rendered more necessary than ever, owing to the fact that the rain-gauge sheets now supplied by the Office are not so carefully cut as was formerly the case.

The thermometers for eye-observations were all found to be in good order, and I determined the freezing points to be as follows:

	°
Dry bulb Standard No. 383 - -	32·3
Wet „ „ „ 388 - -	32·2
Maximum No. 104 - - -	32·2
Minimum „ 308 - - -	31·8

A new cistern for the thermograph wet bulb is greatly needed.

With the view of reducing the barometer residual correction to a minimum, I instructed Mr. Olive to fit an adjusting screw to the barograph tabulating instrument. This he did satisfactorily.

The photography at this Observatory being in an unsatisfactory condition, I endeavoured to find the cause, but regret that I was unable to assign any definite reason for the failures, and could only offer a few suggestions which may possibly bring about better results.

Wilson Fox, Esq., the recently appointed secretary to the Royal Cornwall Polytechnic Society, visited the Observatory during my inspection.

Valentia Observatory, visited August 27th.—Both barograph and thermograph were found to be in good condition, only requiring the usual cleaning of lenses and oiling of clocks.

In order to improve the working of the thermograph light stop, I put a small weight upon the lever, with good effect.

The thermometers were all in proper order, but finding the maximum and minimum were in a separate wall-screen, somewhat sheltered by ivy, I fitted a board in the thermograph screen and removed the thermometers to it, so that they now occupy a similar position to the maximum and minimum thermometers in the other observatories.

Having examined and cleaned the clock and registering portion of the anemometer, I dismounted the external parts, with the view of determining the cause of the defective action of the instrument in the beginning of the year. I found it to lie in the bottom bearing of the vane shaft, which was much rusted, owing to the inability of Mr. Cullum to oil it without dismounting the whole apparatus.

By the kindness of the mechanician at the telegraph station, I was enabled to drill an oil hole through the base of the anemometer column, which will allow the oil to penetrate to the place desired.

The skipping of the direction pencil, to which attention has been called by Mr. Curtis, is due to backlash in the gearing, which allows the vane to shift through a considerable angle, 10° or 15°, without moving the pencil. When therefore a small change in the direction of the wind occurs the

pencil does not at once indicate it, but rolls round with the cylinder, and therefore does not mark the paper until it meets with the resistance offered by the next tooth. Part of the backlash is due to imperfect fitting of the wheelwork, which cannot well be rectified, and part to the pins connecting the shafts, which, having by long use worn their holes oval, now allow considerable shake. This defect might be remedied by fitting new and larger pins to the holes in both shafts and hook joints.

The Beckley rain-gauge was working well, but a new brass tube to conduct the water from the funnel to the bottle is wanted badly, the present lead one having been broken and roughly repaired several times.

Mr. Cullum requests that he may be supplied with a screw wrench to enable him to readily open and oil the instruments.

Armagh Observatory, visited September 3rd and 4th.—Complaint has been made of the working of the light stops at this Observatory. I carefully examined the clocks, but was unable to find any defects beyond those incidental to all of the instruments, viz., want of sufficient weight in the levers to actuate the stop arrangement.

I instructed Mr. Call as to the fixing on of the necessary weights, if the clock again causes him trouble.

With this exception, all the instruments were in thorough order.

The anemograph seems to be carefully maintained throughout; the failure in the velocity trace during light winds is entirely due to the pencil having a right-handed thread instead of a left-handed one, and therefore it rotates with the cylinder and not against it. To remedy this defect, considerable alterations would be required in the instrument, and no real advantage would be gained by the operation.

At the time of my visit a suitable pencil was fitted to the Beckley rain-gauge, and its action was quite satisfactory.

At Mr. Call's request, I made an independent tabulation of some thermograms, and found we did not differ in our estimation more than about 0°·01 on the mean.

Stonyhurst Observatory, visited September 8th and 9th.—My attention at this Observatory was principally directed to the anemograph, the action of which is defective in the same respects as the Valentia one. The instrument, being made by Beck, is similar to that at Valentia, and the failure of the direction pencil to mark at times is here also due to the rolling of the pencil with the cylinder whenever a change occurs in the wind's direction. The slip or backlash was found to be to a great extent due to bad fitting of the pins connecting up the shafting. These were accordingly removed and new pins turned and fitted by the assistance of Mr. Carlyle. The shake in the Hook's joints could not be removed with the appliances we had at hand, and so, as in the case of Valentia, I was obliged to leave the instrument still in a somewhat defective condition. The effect is to cause a sudden shift of the wind through a small arc to be registered as though it occupied half an hour or more, and also to reduce the amount of fluctuation recorded during high winds.

The barograph was in excellent order, but with a view to removing a cause of failure of light with low readings of the barometer, I raised the gas-burner about a quarter of an inch, but as the fitting has been made a fixture, it was necessary to block it up by inserting two small pieces of wood. These appeared to answer the desired purpose fully, so I left them. The thermograph was in good order, and no trouble has been experienced with the thermometer, accidently deranged last January, since it was set right.

The maximum for eye-observations is in good order, but the Casella minimum is very unsatisfactory in its action, and a new one is wanted.

I would call the attention of the Council to the fact that duplicate curves are not produced at this Observatory, so that in case of failure of the sheets or loss in postal transmission, there is nothing to fall back upon for the maintenance of the record.

Glasgow Observatory, visited October 7th.—The barograph and thermograph at this Observatory were in good order, but I considered it desirable to have both clocks cleaned. After this was done it was found very troublesome to get the light stop gear to work properly, owing to defects inherent in the clocks. In the event of further difficulty being experienced at this Observatory I have suggested to Professor Grant that he should apply to the Council for new clocks.

As requested by Mr. Scott, I re-focussed the barograph trace, moving the lens about a quarter of an inch. The result appeared quite satisfactory; but the full advantage of the operation will only be seen when the barometer is very low. I found the condensing lens of the wet-bulb thermograph cracked by the heat of the gas burner, but so far as the photography is concerned there is no injurious effect produced by the crack.

The maximum and minimum thermometers in the screen were in good order. I bored some holes through the board on which they are hung in order to allow of better circulation of the air round their bulbs.

The photographic curves produced by Mr. McLean at the time of my visit were the best I have ever seen. He bestows great care upon all his photographic operations.

The anemograph appeared well oiled and in good order, and the Beckley rain gauge was working satisfactorily. I merely oiled the clocks and fittings.

I gave instructions for altering the barograph tabulation to adapt it to the new setting of the barometer, if necessary.

The stencil plates for dating the curves are worn out and new ones required.

Aberdeen Observatory, visited October 11th, 13th, and 14th.—My attention at this Observatory was directed to a change of value said to have taken place in the zero lines of the wet-bulb thermograph

I accordingly examined the instrument, and although I found it possible to raise and lower the thermometer bodily in the frame, yet the zero plate was too tightly fixed to allow of its being shifted. It seems not improbable that the change in the value of the fiducial lines may be due to the rising of the thermometer by age, as the value has been changing for a long time.

The barograph and thermograph, being in good order, had merely their lenses cleaned and clocks oiled. The anemograph was also working well and in very fair adjustment, so the pencils were left very slightly overlapping the traces, as they were found.

The rain-gauge was satisfactory in every respect, and the pencil found when tested to return exactly to the top of the trace. The observer, Mr. Boswell, complains of the irregularity in the the ruling of the last batch of rain-gauge and anemometer blank curves supplied to him.

Holyhead, visited September 6th.—The anemograph here is very carefully kept and oiled, but being one of Messrs. Beck's construction has the same defects as the instruments at Valentia and Stonyhurst. Mr. Williams has experienced some difficulty in keeping the vane shaft properly oiled. I accordingly instructed him to drill an oil hole in the bottom of the column, in the same place as I made one at Valencia.

G. M. WHIPPLE.

Reported—That Mr. Barry's rooms in No. 113 had been taken from the 15th of August, at a rent of 70*l.* per annum, the premium for the lease, with $5\frac{1}{2}$ years to run, being 150*l.*

Reported—That Mr. R. H. Curtis had tested the harmonic analyser at Mr. Munro's workshop, and had suggested some small alterations, which had been approved by Professor Stokes, and were in process of execution.

Read—An application (Letter 2626) for a fishery barometer for Douglas, Isle of Man.—Granted.

Submitted—Report on the Meteorology of Kerguelen Island, in proof.

The meeting was then adjourned.

116, *Victoria Street, November* 15, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	GENERAL STRACHEY.
MR. GALTON.	PROFESSOR STOKES.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (October 29) were read and confirmed.

Read—A letter from Mr. Lecky (No. 2754), undertaking to make 20 stands for Sunshine Recorders, of the pattern approved at last meeting, for 2*l.* 10*s.* apiece.

Resolved—That Mr. Lecky's tender be accepted, and that 30 stands be ordered; five of the rings not to be cut till required.

The Secretary submitted a map showing proposed distribution of the instruments (as directed). The map was provisionally approved: the details to be finally settled after consultation with Professor Stokes and Mr. Galton.

It was resolved that 10 more glass spheres be ordered of Messrs. Chance.

Professor Stokes stated that Mr. Munro had forwarded an estimate (Letter 2812), with drawings, for a bridled anemometer (Minutes, p. 52).

The cost of the instrument giving—

(1.) A continuous record of direction and velocity would be 76*l.* 10*s.*
(2.) A continuous record of velocity only would be 58*l.*
(3.) Both indications, but not a continuous record, would be 39*l.*

The charge in each case being for a first instrument inclusive of the drawings and patterns.

Mr. De La Rue stated that he did not consider Mr. Munro's estimates for the bridled anemometers too high, when it was taken into consideration that a large part of the cost consisted in the structures necessary to support them. Also that in his opinion it is desirable to have a bridled anemometer constructed, in order that the principle of the instrument may be fairly tested.

Reported—That the three current Charts for the Cape squares had been forwarded to the lithographer, as ordered at last meeting, and that current lines had been drawn on the July Chart.

Resolved—That current Charts for the remaining eight months of the year be prepared and lithographed.

Submitted—A draft reply to Mr. Patey's letter (No. 1926, Minutes, p. 24), which was approved, and the Secretary was ordered to forward it (Letter 2932).

The Secretary submitted the following report:—

REPORT ON WEATHER TELEGRAPHY DURING THE PAST FIVE MONTHS.

GENTLEMEN,

I HAVE to report that in accordance with your instructions (Minutes, pp. 27–29) extra messages for the improvement of the afternoon forecasts were organized during the time that the Hay Harvest Forecasts were being prepared. These messages were obtained from—

Nottingham Hurst Castle St. Ann's Head
Donaghadee Roche's Point.

Their cost for about eight weeks was 12*l.*

The cost of issue of the Hay Harvest Forecasts amounted to 50*l.* 2*s.* 6*d.*

The private inquiries for meteorological information have yielded a small sum, averaging monthly 2*l.* 4*s.*, viz., inquiries by telegraph, 1*l.* 10*s.*; inquiries at the Office, 14*s.*

The following is the present distribution of Forecasts:—

11 *a.m. Forecasts.*

14 MS. copies prepared; 9 to (2) press agencies, 3 to newspapers, 2 to subscribers.

80 copies printed; 55, with Daily Weather Report, to Dangerfield, 1 to subscriber, 20 copies retained in stock; a few copies distributed in Office.

4 *p.m. Forecasts.*

28 MS. copies prepared; 27 copies to (3) press agencies, 1 copy to newspaper.

330 copies printed; 7 to special subscribers, 10 to newspapers, 18 to clubs, 10 to City and West End (free), 7 distributed in Office, 280 sent out with Daily Weather Report, 20 copies in store.

Sundays.

27 MS. copies prepared; 14 to (2) press agencies, 13 to newspapers. None printed.

In accordance with instructions (Minutes, p. 29) I organized daily reports for the three London Newspapers, from Paris (6 p.m.), Puy de Dôme (8 a.m.), and also from Switzerland (Minutes, p. 31) The total cost of the two French reports for six weeks was about 12*l.*, so that their average yearly cost would be about 120*l.*

The Swiss reports for 24 days cost 7*l.*, which gives an annual cost of about 110*l.*

The total cost of the French and Swiss reports would therefore amount to about 230*l.* a year.

All of these extra reports ceased on the 30th of September, and I await instructions for their resumption.

Negotiations were also opened for the receipt of 6 p.m. reports from Ile d'Aix (off Rochefort). These await the approval of Council. Their cost will be about 60*l.* per annum. (Letters 2171, 2220, 2258, 2292.)

Application was also made to the Danish authorities for a 6 p.m. report from Skagen. This has been most liberally conceded, and it arrives free of charge.

To Norway application was made for 6 p.m. reports from Skudesnaes and Christiansund. Professor Mohn reports (Letter 2197) that the request can be granted if the observers receive an allowance of about 12*l.* apiece annually, it being supposed that the messages travel free. He also states that the 8 a.m. reports from Bodö (in 67° 15′ N.) can be supplied gratis if desired.

I have also made application to the German authorities for a 6 p.m. report from Cuxhaven, but I learn (Letter 1993) that there are local difficulties in the way of the transmission of this report, which it is hoped will be ultimately overcome.

I have consulted with Mr. Gaster, who suggests that the reports most desirable for us to obtain for 6 p.m. are those from Paris, Ile d'Aix, and Cuxhaven (if procurable). If any of these reports could be obtained free, a report from Brussels would be very useful.

I have further to report that the present cost of the 6 p.m. reports from 16 inland stations is about 700*l.*, being an increase of 200*l.* on the cost of the system at first, when reports were only received from 10 stations.

The balance, therefore, available out of the amount (900*l.*) received from the three London newspapers is about 200*l.*

The Swiss reports would cost 110*l.*

As regards the entire question of foreign telegrams, I have inquired privately of Mr. Patey wha change, if any, would be made in existing tariffs for the transmission of meteorological telegrams. His reply was as follows :—

"After March next messages will be charged at a word tariff, cost of 15 words being equal to present cost for 20 (five figures charged as a word)."

I expect that this change will have a somewhat favourable effect upon the cost of the reports from our stations which are forwarded in figures; but it will very seriously increase the charge for our daily resumé, in words, sent to Paris, unless this be drawn up in cypher.

Nov. 19, 1879. ROBERT H. SCOTT.

The Council instructed the Secretary to organize 6 p.m. reports from Paris, Ile d'Aix, the Norwegian stations, and Cuxhaven (if possible).

The Secretary submitted the following correspondence relating to the arrangements for supplying the 8 p.m. Forecasts to newspapers :—

Letter 2178 from "The Times."
„ 2624 from the manager, "Central News."
„ 2686 from Sir M. Wilson, M.P. (with reply Letter 2831).
„ 2691 from "The Times."

Resolved—I. That it is expedient, with the concurrence of the three newspapers at present subscribing, to make arrangements by which 8 p.m. Forecasts may be communicated to all newspapers willing to subscribe a moderate annual sum; II. That the Chairman and Secretary be authorised to bring this proposal under the notice of the managers of the three newspapers; and, III. That a memorandum be prepared, for submission to the Treasury, explaining the nature of the existing and of the proposed arrangements relating to the publication of Forecasts.

The recommendations contained in Mr. Whipple's Report of Inspection (Minutes, p. 74), were ordered to be carried out.

The Report of the Irish Inspections was taken into consideration (Minutes, p. 69), and it was resolved—

I. To make arrangements for the substitution of Parsonstown for Kingstown as a reporting station.

II. To accept Colonel Martin's offer to have experiments on the influence of height on meteorological observations made on the scaffolding at the Mountjoy Observatory.

III. To obtain an estimate for the cost of the repairs required at Valencia.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting four logs had been received, two of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Sir G. S. Nares, K.C.B., log kept by Sub-Lieut. J. H. C. East.	H.M.S. "Alert"	Sept. 24, 1878—May 31, 1879.	To Straits of Magellan and surveying in that district.	1878, p. 33.
W. H. Stuart -	Schooner "Richmond."	May 5, 1875—July 24, 1876.	Cruising amongst the Bahama Islands.	1876, p. 75.

Mr. Scott was instructed to convey the best thanks of the Council to the abovementioned observers, and to present the Charts (O. 32) to Mr. East.

M.O. 2660.

STATEMENT of WORK done in PANTAGRAPH ROOM during October 1879.

October 31, 1879.

Eight Copper Plates have been engraved, viz.: plates 37–42, 1879; and plates 31–32, 1876.

Zinc Plates.—Barograms 7 plates, Nos. 37–42, 1879, and No. 37, 1876; Thermograms 9 plates, Nos. 37–42, 1879, and Nos. 37–39, 1876; Anemograms 8 plates, Nos. 39–43, 1879, and Nos 31–33, 1876; Rain Curves 8 plates, 37–42, 1879, and Nos. 31–32, 1876; Vapour Tension 10 plates, 37–42, 1879, and Nos. 36–39, 1876.

Photographic Curves have been prepared to Plate 42 for thermograms, and Plate 44 for barograms 1879.

The July (1879) plates having been finished before the examination of the August tabulations was completed, those for 1876 were taken in hand in order to avoid confusion. I propose to continue

working on them until sufficient progress has been made with the August 1879 zinc plates, to ensure continuous work for the Wagner pantagraph to the end of the month.

The tabulations for August (except those for *Aberdeen*) were received from Mr. Allen on the 28th, and the writing of the Remark Sheets has been begun to-day.

Mr. Allen's report is attached.

R. H. CURTIS.

R. H. Scott, Esq., F.R.S.

STATEMENT of WORK done in the EXAMINATION ROOM during October 1879.

October 28, 1879.

Examination of the curves and tabulations for—

August.—Completed (except for Aberdeen).

September.—The two Irish stations completed, and the thermograms for the other stations now being proceeded with.

T. E. ALLEN.

To R. H. Scott, Esq., M.A., F.R.S.,
Secretary of Meteorological Council.

STATEMENT of WORK done in MARINE ROOM during October 1879.

November, 1879.

New logs examined 11 in number.

Cape of Good Hope District.

Winds.—Tabulation finished for 3 Sn. Squares. This completes the tabulation of winds for all months for six Cape Squares.

Air Temperature.—Meaned and plotted for single-degree squares for July and partly for January.

Currents.—July and October individual currents plotted.

Sea-Surface Temperature.—Noon observations charted for July and partly for January. Drawing various specimen sea temperature-roses, &c.

Cape Gale Tables.—April gales tabulated.

Various work in connexion with Mr. Galton's paper on the discussion of wind observations.

Collection of Data for Indian Government.—The extraction of data for July to December completed. Duplicate commenced.

CHARLES HARDING.

R. H. Scott, Esq.

Reported—That General Strachey had suggested some slight alterations in the proof of the "Report on the Meteorology of Kerguelen" submitted at last meeting. The paper was approved for press.

General Strachey reported in favour of the paper "Contributions to Arctic Meteorology," Part II., which had been referred to him (p. 50), and it was resolved that the paper be printed.

The Secretary reported that Colonel Parsons had forwarded to the Office the full series of unpublished meteorological returns, taken at the Royal Engineer stations at home and abroad from 1852 to 1861, and submitted the following list of these returns :—

LIST of the CONTENTS of TEN VOLUMES of OBSERVATIONS received from the Ordnance Survey Office at Southampton.

The Observations were taken twice daily, viz., at 9.30 a.m. and 3.30 p.m., local time, and comprise: Pressure; Temperature, including maxima in shade and in sun, and minima in shade and on grass; Hygrometry; Wind; Rainfall; Cloud and Weather. Coloured diagrams accompany most of the returns.

Stations in the British Islands:

Edinburgh	January 1852 to December 1854.
Curragh	June 1860 to September 1861.
Chatham	January 1854, and May to December 1861.
Guernsey	January 1852 to December 1859, but not quite complete.

Foreign Stations:

Bahamas, Ceylon, Corfu, Gibraltar, Halifax, Jamaica, Mauritius, Newfoundland — 1852 to 1861. The series is not complete in every case.

Foreign Stations:

Auckland, N.Z. - -	1853 to 1861. The series is not complete in every case.
Barbadoes - -	
Graham's Town, S.A. -	
Hong Kong - -	
Kingston Canada West -	
St. Helena - -	
Malta - - -	April 1852 to January 1855 (omitting July, August, and September 1854), and June 1857 to August 1861.
Bermuda - -	May 1852 to July 1853 (with gaps), and August 1855 to December 1861.
Freemantle, W.A. -	July 1852 to December 1855, also February and March 1859.
Quebec - - -	May 1853 to March 1855, also July 1858 to June 1861.
Ascension - -	September 1858 to September 1861, with many gaps.
British Columbia -	December 1859 to December 1861, excepting June 1860.
Guatemala - -	July, August, and September 1860.

Reported—That the Daily Weather Charts had been supplied gratis to the General Register Office, Ireland.—Approved.

Reported—That Mr. H. Newton had been appointed a clerk to the Local Government Board, and had resigned his clerkship in the Office.

The following list of subjects (exclusive of those relating to the Cape Squares and to the Pacific) already brought before the Council, but awaiting further action, was submitted :—

1. *Questions relating to the Telegraphic System.*

2. *Questions relating to the issue of Forecasts and Weather Information to the public and to the newspapers.*

3. *Synchronous observations on board Her Majesty's ships* (Minutes, pp. 46, 69).—The Instructions to observers and Forms of Registry, in draft, will be submitted on the 29th instant.

3A. *Synchronous Charts* (Minutes, 1878, p. 145).

4. *Proposal to receive Daily Telegrams from America* (Minutes, p. 47).—Correspondence will be submitted.

5. *Cirrus observations* (p. 33).—This subject is at present in the hands of Mr. Gaster.

6, "*Aids to the Study and Forecast of Weather.*"—Mr. Ley's portion is nearly ready (p. 49).
The completion of Mr. Abercromby's portion has been prevented by his ill-health.

7. *The Quarterly Summary of the Weekly Weather Report* (Minutes, p. 41) is nearly ready, and a specimen table will be submitted at next meeting.

8. *The Quarterly Weather Report.*—The following plates are ready: 1876, January 1–July 4; 1879, January 1–July 29.
No part of the text is as yet ready, but a specimen for one month in 1879 shall be submitted at next meeting (Minutes, 1878, pp. 97, 117).

9. *Sea Temperature Observations on the coasts of the British Islands* (Minutes, 1878, p. 118).—The discussion of the old series of observations will be nearly completed by Mr. Strachan by the end of the year.
The new system of observations commenced on the 1st of July. Thirty-nine schedules have come in for the first quarter. Eight are in arrear, and application has been made for them.
The screen for thermometer exposure at these stations is being tested at Kew.

10. *Proposal to employ an agent in London to assist in obtaining observers in the Mercantile Marine.*

11. *Application for the loan of instruments to a proposed Station at Patras, Greece.*

12. *Organization of stations in Cyprus* (Minutes, p. 30).—A letter (No. 1888) was received from the Governor (dated July 12), and stating that he wished to establish three stations in addition to that proposed at Larnaca under Staff Commander Bond, instead of two only, as suggested by Council. The sanction of the Foreign Office having been obtained to direct communications between this Office and the Governor, letters were written on the 13th of August (Nos. 2106, 2107) to his Excellency and to Staff Commander Bond, asking for full particulars as to the arrangements for taking the observations. These have not yet been received, so that the instruments have not yet been forwarded.

13. *The Fishery Exhibition at Berlin* (Minutes, p. 30).

14. *The Harmonic Analyser* is ready for delivery. The Council have to consider—
(*a.*) What series of curves should be first treated.
(*b.*) What arrangements should be made for working the instrument.

15. *The Kew Committee make application for a battery to test the Electrograph.*

16. *The large Globe to be employed for charting physical constants,* as suggested by Sir H. Lefroy (Minutes, p. 47), has been delivered.

17. *The Sunshine Recorders.*—The distribution of these has been provisionally approved, and it is hoped that 20 will be in their places by January 1, 1880.

18. *Evaporation.*—Two of Mr. De La Rue's instruments are being tested at Kew against each other (Minutes, p. 50).

One of Piche's instruments has been procured.

The Chairman's report on Mr. Greaves' method has to be considered (Minutes, 1878, p. 45).

19. *Comparison of Marine Barometers with Aneroids.*—The instruments for use on board the "Trinity" Yatch attending the Eddystone lighthouse works, viz., 1 barometer, 1 barometer with gimbals altered, 1 aneroid, have been sent to the yacht; the observations will be taken by Mr. Douglass, jun., C.E. (Minutes, p. 47).

20. *Meteorograph.*—Mr. Darwin (Minutes, 1878, p. 44) will shortly send in a report on the instrument proposed by him.

21. *Cloud Photography.*—Captain Abney (Minutes, p. 2) will send in a report and attend at next meeting.

22. *Thermometer Exposure.*

(*a.*) Mr. Symons' discussion (Minutes, 1878, p. 43) will, it is hoped, be ready at the end of the year.

(*b.*) Comparative observations are in progress at Kew on the Russian and English stands.

(*c.*) It has been suggested that the scaffolding at Mountjoy observatory, Phœnix Park, Dublin, could be used for experiments on the influence of height on temperature.

(*d.*) The paper on the Kew Pagoda results (Minutes, 1878, p. 38) has been completed, and is ready for submission to the Royal Society.

(*e.*) Mr. Gill of the Cape Observatory presses for information on the subject of thermometer exposure.

23. *Hygrometry.*—Mr. Shaw (Minutes, p. 50) is prepared to undertake these experiments as soon as the Cavendish Laboratory is re-opened. The requisite apparatus has been procured for him.

24. *Radcliffe Observatory.*—A proposal will be made by the Chairman to send to Mr. Stone, for one year, the spare set of self-recording apparatus belonging to the Council.

25. *Anemometry*:—

(*a.*) Negotiations with the Trinity House (Minutes, 1878, p. 112).

(*b.*) Bridled Anemometer (Minutes, p. 76).

(*c.*) Instrument on Queen Ann's Mansions (Minutes, p. 44).

(*d.*) Instrument for Sombrero (Minutes, p. 50).

(*e.*) M. Hagemann's Anemometer has been sent to Kew (Minutes, p. 73).

26. *Cape of Good Hope barometer comparison.*—In progress (Minutes, p. 48).

27. *Barometers without "Marine Contraction."*—A supply of these has been received, and they will be issued to the telegraph stations as opportunity offers.

The following cheques for October were drawn on the 31st of that month:—

			£	s.	d.
Administration:					
R. H. Scott, salary			66	13	4
Special Researches:					
L. P. Casella, hygrometer			3	16	8
L. Golaz, „			5	17	5
Office Expenses:					
J. S. Harding, jun. } Salaries and wages	27 15 6				
T. D. Bell }	12 15 6				
J. S. Harding, sen. }	*8 19 8				
		49	10	8
Pall Mall Coal Co., coals		2	2	0
Pickford & Co., carriages of parcels		1	11	9
Land Meteorology:					
J. E. Cullum, Valencia		15	16	8
R. H. Curtis } Discussion, &c. of observations	22 4 5				
J. A. Curtis }	15 11 1				
T. E. Allen }	15 11 1				
C. H. Thompson }	*9 4 0				
E. G. Aldridge }	*7 6 8				
		69	17	3
Weather Telegraphy:					
F. Dangerfield, delivery of Daily Weather Charts		12	3	0
J. J. Hicks, thermometer screen		1	15	0
Postmaster General, telegrams for August		206	1	5
Wightman & Co., printing forecasts		32	7	3
Carried forward		467	12	5

* Four weeks to the 25th October.

		£	s.	d.	£	s.	d.
	Brought forward -	-		-	467	12	5
F. Gaster -	Preparation, &c. of Weather Reports.	29	1	6			
W. L. Dallas -		20	12	1			
F. Brodie -		18	13	8			
H. W. Chivers -		*6	12	0			
					74	19	3
Ocean Meteorology:							
E. Price Edwards, advertisements - -		-		-	1	2	6
J. R. Jones, Aberdeen agent - - -		-		-	7	7	7
H. J. Thatcher, Cardiff „ - - -		-		-	11	11	9
P. A. Feathers, Dundee „ - - -		-		-	2	10	0
J. Gill, Liverpool „ - - -		-		-	21	6	0
D. MacGregor & Co., Glasgow agents - -		-		-	5	7	9
R. W. Munro, wind-area instrument - -		-		-	43	10	0
A. G. Evans, care of Bermuda anemometer -		3	1	0			
„ „ „ „ -		4	12	0			
					7	13	0
Captain H. Toynbee -	Reduction, &c. of Observations and care of instruments.	33	6	8			
R. Strachan - -		27	15	6			
C. Harding - -		22	4	5			
H. Harries - -		*11	4	0			
Nav.-Lieut. C. W. Baillie		16	13	4			
					111	3	11
C. Harding, observations for India Office -		-		-	2	6	4
W. Allingham „ „ -		-		-	2	0	10
Miscellaneous:							
P. Adie, commissions - - - -		-		-	4	2	0
J. J. Hicks, „ - - - -		-		-	1	15	0
Hopkin & Williams, commissions - -		-		-	6	9	7
J. S. Harding, jun., petty cash - - -		-		-	150	0	0
„ „ - - -		-		-	100	0	0
	Total	-			£1,020	17	11

On the 7th instant a cheque for 9*l.* 10*s.* was drawn in favour of Mr. F. Barry, for fixtures at No. 113, Victoria Street.

* Four weeks to the 25th October.

The Council then adjourned.

116, *Victoria Street, November* 29, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	PROFESSOR STOKES.
MR. GALTON.	GENERAL STRACHEY.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (November 15) were read and confirmed.

The subject of the bridled anemometer (Minutes, p. 76) was taken into consideration, and it was resolved that a bridled anemometer without a vane be ordered from Mr. Munro; that the instrument be furnished with two snails, one for pressure, the other for the square root of the pressure, and also with certain other adjuncts suggested by Professor Stokes, for experimental purposes; and that Professor Stokes be requested to communicate with Mr. Munro on the subject.

The amended map, showing the proposed distribution of the sunshine recorders, was submitted and approved, with an instruction to the Secretary to have at least one instrument erected in London itself.

The following is the list of stations to be furnished with sunshine recorders in the different agricultural districts.

0.	Scotland, North	Stornoway, Sandwick.
1.	Scotland, East	Aberdeen, Glenalmond.
2.	England, North-East	Durham, York, Kelstern (Lincolnshire).
3.	England, East	Cambridge, Hillington (Norfolk).
4.	Midland Counties	Leicester, Oxford.
5.	England, South	London (2), Kew, Southampton, Jersey.
6.	Scotland, West	Glasgow, Douglas, Silloth.
7.	England, North-West	Stonyhurst, Llandudno, Churchstoke.
8.	England, South-West	St. Ann's Head, Falmouth, Cirencester.
9.	Ireland, North	Armagh, Markree.
10.	Ireland, South	Dublin, Parsonstown, Valencia.

The Chairman reported that, after consultation with Mr. Galton, he had given instructions that Air Temperature Charts and Barometer Charts of the Cape Squares should be prepared for the months of January and July, upon the same principle as the Mean Sea Temperature Chart, showing the means and range for single-degree squares, already prepared for July.—These instructions were approved.

The Chairman reported the result of an interview which the Secretary and himself had had on the 20th instant with Mr. MacDonald, of the "Times," on the subject of the issue of 8 p.m. forecasts to newspapers (Minutes, November 15).

The Chairman also submitted the following proposal for a re-arrangement of the daily issues of weather information and forecasts.

At present, besides the 8 p.m. forecasts supplied to the three subscribing newspapers, two printed forecasts are issued to the public *per diem*, viz.:—

(A.) One at 11 *a.m.*, founded on the 8 a.m. reports.

(B.) The other at 4 *p.m.*, founded on the 2 p.m. reports.

It is suggested that instead of these forecasts (A. and B.) a single one might be issued at 2 *p.m.* daily, the afternoon reports on which it is based, being fixed at 0h. 43m. p.m. instead of at 2 p.m.

The reasons for this suggestion are—

(1.) It may be questioned whether three forecasts a day are not too much, both for the public and for the staff of the Office.

(2.) The 4 p.m. forecast (B) barely reaches the City in time to be seen by business men before leaving. A 2 *p.m.* forecast would probably suit their convenience better.

(3.) The 4 p.m. forecast (B) comes too near in point of time to the 8 p.m. forecast issued to the three subscribing newspapers.

An eleven o'clock forecast might still be prepared for issue, not to the general public, but to the later editions of the morning papers, and the earlier editions of the evening papers. Of course for this issue some moderate charge would be made.

The suggested changes would not interfere in any way with the supply of information from the Office to private inquirers.

The proposed re-arrangement was approved, and it was agreed that it should come into operation on January 1st, 1880.

Submitted—A form for the 0h. 43m. synchronous observations on board H.M. Ships (Minutes, p. 69), which was ordered to be set up in type and re-submitted.

Mr. De La Rue presented the following report on the Harmonic Analyser:—

November 28, 1879.

I WENT to Mr. Munro's yesterday and saw the Harmonic Analyser, which appears to work very smoothly; the cranks, however, are not *individually* counterbalanced. It is true that they stand alternately at right angles, and the machine works well, still it is well that we should remember the counterbalancing which Mr. Munro has misunderstood.

He was to have made crossed lines on glass as a temporary substitute for the pointer, which obscures the further side of the trace, and moreover might occasionally tear the curves; this would not take place with the glass plate pointer. It was to be done in time for Mr. Curtis to see yesterday afternoon.

I told Mr. Munro also to make in steel the gauge he had prepared in brass (for his own use) for adjusting the balls and forks centrally with the discs.

(Signed) WARREN DE LA RUE.

Mr. Curtis' report on the instrument was also submitted:—

SIR, November 28, 1879.

As requested by you I went yesterday to Mr. Munro's works to see the *Harmonic Analyser*, which is now completed and ready for delivery to this Office. The instrument is 9 feet 3 inches long and 2 feet wide.

I examined it carefully in every part to test the accuracy of its construction, and to ensure as far as possible that nothing necessary had been omitted. Each pair of cranks was ungeared and tried separately; the spheres tested as to accuracy, the working of the pointers, the arrangement for expanding the cylinder, &c. examined, and in all respects the instrument appeared to me to be very satisfactory and to work well.

Mr. Munro had etched cross lines on a small glass plate, and a dot in a circle on another; these were alternately fitted to the instrument in place of the pointer, in order that whilst the trace was being followed its further side should not be obscured, and also that it should run no risk of being torn.

Neither of the temporary plates could, however, be used, first because the *dark* line could not be seen on the *dark* trace, and chiefly because the curvature of the glass was not adapted to the cylinder.

I am, &c.

R. H. Scott, Esq., F.R.S. R. H. CURTIS.

It was ordered that the instrument be brought to the Office and placed in the "Land Meteorology" Room, the Chairman and Secretary to report at next meeting as to the arrangements to be made in the Office for working it.

Professor Stokes was requested to prepare a memorandum relating to the work to be in the first instance undertaken with the Harmonic Analyser.

Read—The following letter (M. O. 2894, Minutes, p. 2):

SIR, Science and Art Department, November 28, 1879.

I DULY laid the letter of your Chairman before "My Lords," and have the pleasure to state that they have no objection to my undertaking the duties with which your Council has proposed to charge me.

I have, &c.

The Secretary, Meteorological Council. (Signed) W. DE W. ABNEY, Captain, R.E.

Captain Abney attended the Council by request.

I. He exhibited (Minutes, p. 2) a model (two thirds of the full size) of an arrangement for taking cloud photographs, consisting of an altazimuth mounting of cameras on tripod stands with legs admitting of adjustment in length, for work on a hill side. The arrangement enables the two lenses to be adjusted to a common line of collimation, thus giving a zero point; it also includes an apparatus for simultaneous

exposure, the two cameras being provided with pneumatic shutters, which can be worked by means of an electro-magnetic contrivance.

The Council approved of the arrangement proposed by Captain Abney, and authorised him to order a pair of the cameras at an expense not exceeding 50*l.*

II. Captain Abney also reported, with regard to the difficulties which he knew to arise from time to time in the waxed paper process of photographic records, that if the paper were waxed, not before development of the traces, but afterwards, these difficulties could be got over; and he added that it would perhaps be better to discard the use of wax altogether. Captain Abney was requested to have some trials made at Kew of the process proposed by him.

III. He also stated that Mr. Horace Darwin had, after consultation with himself, nearly completed an arrangement for recording the chemical effect of total daylight (this arrangement being a modification of Professor Roscoe's instrument). The Secretary was directed to write to Mr. Horace Darwin, asking him to forward to the Council (as soon as he should be in a position to do so conveniently) a description of the arrangement illustrated by a photograph.

Submitted—Letter 2834 from Mr. Horace Darwin describing his mechanical meteorograph (Minutes 1878, p. 44).

Resolved—That Mr. Darwin be requested to send his instrument to the Office.

The following cheques for November were drawn on this day :—

	£ s. d.	£ s. d.
Administration :		
R. H. Scott, salary	-	66 13 4
Special Researches :		
R. J. Lecky, sunshine recorders	-	10 5 0
Office Expenses :		
J. S. Harding, jun. } Salaries and wages	27 15 6	
T. D. Bell } Salaries and wages	12 15 6	
J. S. Harding, sen. } Salaries and wages	*11 4 7	
		51 15 7
H. Bond & Son, furniture hire	-	1 9 6
Pickford & Co., carriage of parcels	-	1 19 6
J. Weeks & Co., hot-water apparatus	-	27 11 6
Land Meteorology :		
J. E. Cullum, salary	-	15 16 8
Hopkin & Williams, chemicals	7 1 3	
„ sperm oil	0 11 1	
		7 12 4
R. H. Curtis } Reduction, &c. of Observations	22 4 5	
J. A. Curtis } Reduction, &c. of Observations	15 11 1	
T. E. Allen } Reduction, &c. of Observations	15 11 1	
C. H. Thompson } Reduction, &c. of Observations	†9 4 0	
E. G. Aldridge } Reduction, &c. of Observations	†7 6 8	
		69 17 3
Weather Telegraphy :		
Postmaster General { Telegrams	188 14 5	
Postmaster General { Forecasts	5 15 0	
		194 9 5
F. Gaster } Preparation, &c. of Weather Reports	30 7 6	
W. L. Dallas } Preparation, &c. of Weather Reports	20 12 1	
F. Brodie } Preparation, &c. of Weather Reports	18 13 8	
H. W. Chivers } Preparation, &c. of Weather Reports	*8 5 0	
		77 18 3
Carried forward	-	£525 8 4

* Five weeks to the 29th instant.
† Four „ „

		£	s.	d.	£	s.	d.
	Brought forward -	-		-	525	8	4
Inspections:							
A. Buchan, travelling expenses - -		-		-	3	7	3
G. M. Whipple „ - -		-		-	16	1	8
W. Marriott -	Proportion of Meteorological Society's expenses.	-		-	25	0	0
Ocean Meteorology:							
King, Seymour, & Co., Southampton, agents -		-		-	3	5	6
B. M. Allingham -	Copying data for India Office.	-		-	5	12	8
A. Canham -		-		-	3	10	8
E. Curtis - -		-		-	5	8	5
S. A. Harding -		-		-	4	5	6
S. E. Harding -		-		-	2	17	3
J. E. Harries -		-		-	6	9	6
M. James - -		-		-	6	8	2
E. Rigby - -		-		-	5	12	0
E. J. Strachan -		-		-	4	3	1
Captain H. Toynbee	Discussion, &c. of observations and care of instruments.	33	6	8			
R. Strachan -		27	15	6			
C. Harding -		22	4	5			
H. Harries -		*14	0	0			
C. W. Baillie -		16	13	4			
					113	19	11
Miscellaneous:							
J. S. Harding, jun., current expenses - -		-		-	100	0	0
„ „ - -		-		-	80	0	0
					£911	9	11

Reported—That a cheque for 50*l.* had also been drawn on the 20th instant in favour of Mr. R. W. Munro on account of the "Harmonic Analyser."

* Five weeks to the 29th instant.

The Council then adjourned.

116, *Victoria Street, December* 13, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | PROFESSOR STOKES.
MR. GALTON. | GENERAL STRACHEY.
THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (November 29) were read and confirmed.

Submitted—The following draft letter and memorandum, which were adopted, and the Secretary was instructed to forward them to the Treasury:—

SIR,

THE attention of the Meteorological Council has been called to a circular, of which a copy is enclosed, and of which the ultimate object appears to be to bring under the notice of the Treasury the course pursued by the Meteorological Office in making special arrangements for supplying information to three of the London newspapers; the "Times," "Standard," and "Daily News."

Under these circumstances the Council think it right to lay before their Lordships the enclosed Memorandum, explaining the nature of the existing and contemplated relations between the Office and the newspapers.

I am, &c.

To the Secretary of the Treasury. (Signed) R. H. SCOTT.

MEMORANDUM relating to the SUPPLY of WEATHER INFORMATION to NEWSPAPERS by the METEOROLOGICAL OFFICE.

At the close of 1875, the Meteorological Office agreed to furnish to the "Times" a Meteorological statement at 8 p.m. on each day for publication in the issue of the following morning.

To prepare this statement it was arranged that a certain number of the observations regularly taken at 6 p.m. should be telegraphed to London, and that the Office should be kept open after the usual hours to receive the telegrams, and to prepare the summary of information. The whole of the cost of these extra arrangements, including the attendance after hours of several Post Office servants, and amounting to 500*l.* a year, was borne by the "Times."

It was always understood: (1) That the preparation of the statement should not be regarded as forming any part of the regular work of the Office; (2) That any other paper wishing to receive the information might do so upon agreeing to share in the cost equally with the "Times."

In the Spring of the present year these terms were accepted by the "Standard" and the "Daily News," and it was arranged that each of the three papers should pay 300*l.* a year; that the same charge of 300*l.* a year should be made to any other paper desiring to make use of all or any of the information collected at 6 p.m.; and that the whole sum, now amounting to 900*l.* a year, should be expended in improving the 6 p.m. Reports.

On this footing the matter at present rests.

A subscription of 300*l.* a year is prohibitory to by far the larger number of newspapers, and the Council consider that in the interest of the public they ought, as soon as they may be able, to fix a tariff, rendering the 6 p.m. Meteorological statement accessible upon greatly reduced terms to the generality of the town and country newspapers.

But the question reduces itself to one of money, and the Office is not in a position to supply this information, unless the newspapers on their part are willing to defray the cost of obtaining it. In addition to this, the Council do not think it fair to those newspapers which have hitherto so liberally supported them, to abandon the present arrangement without a reasonable prospect of substituting for it another of at least as great public advantage.

They therefore propose to maintain the existing agreement until they receive offers (say) from 50 newspapers to subscribe the sum of 20*l.* a year each towards the expenses of the 6 p.m. information.

The 1,000*l.* which the Office would thus receive, would enable it to maintain and somewhat to increase the efficiency of the service; while the proposed charge upon the newspapers cannot be regarded as onerous, considering the interest taken by the public at the present time in Meteorology, and the consequent pecuniary value (of which the circular accompanying this memorandum is itself an evidence) of the information supplied.

The Council fully appreciate the services which the daily press has rendered to the public, and to Meteorology itself, by publishing weather information of a scientific kind, and by disseminating the knowledge of meteorological principles; but they do not consider that the funds placed at their disposal by Government can be properly expended in gratuitously supplying information to newspapers; although they recognise the principle that the Office should apply the whole amount of the subscriptions to the service in which the newspapers are specially interested.

As the circular appears to proceed from a gentleman connected with one of the Press Associations, it may be proper to add that the Council would think it right to receive subscriptions from the newspapers *individually*, though they would, of course, be willing to employ Press Associations as agents in the collection of the subscriptions and in the distribution of the information.

Reported—That the Harmonic Analyser had been delivered on the 12th instant. The Chairman and Secretary reported that in their opinion Mr. R. Curtis should devote as much of his time as possible during the next fortnight to the use of the instrument, with a view to obtaining a complete command over it. It was agreed that Mr. R. Curtis should begin with certain systems of straight lines, in order to test the working of the instrument in cases in which the result is known by calculation, and should then continue with the dry-bulb curves for 1870, for which the Bessel's constants have been published.

The Secretary was instructed to write to Sir W. Thomson to inform him that the instrument ordered by the Council was now ready and had been erected at the Office, and to ask for his instructions respecting the model (Minutes, 1878, p. 20).

The draft estimates for 1880–81 were considered and approved, and ordered to be placed on the Minutes.

MATERIALS for preparing ESTIMATES for Year 1880–81.

	Income, or Deductions. £ s. d.	Expenditure. £ s. d.	£
Administration:			
(1.) COUNCIL	-	-	1,000
(2.) SECRETARY	-	-	800
Special Researches and Experiments	-	-	1,000
Office Expenses:			
(1.) Salaries and Wages:			
Present salary of three clerks, office keeper and messenger	-	702 2 8	710
(2.) Rent, Fuel, and Lighting:			
Amount for six months ending March 1879*	-	300 18 5	
Amount for six months ending September 1879†	-	438 6 4	
		739 4 9	
Deduct cost of lease and half-quarter's rent at No. 113	159 0 3		
Add rent for year at No. 113	72 2 0		
		86 18 3	
		652 6 6	650
(3.) Incidental and Contingent Expenses:			
Amount for six months ending March 1879*	19 11 1	273 13 3	
Amount for six months ending September 1879†	9 9 5	263 4 7	
		536 17 10	
Deduct items for alterations in Office, fittings, hot-water apparatus, and other exceptional expenses	102 15 1		
		131 15 7	
		405 2 3	420
Carried forward			£4,580

* Minutes, p. 56 (1878) ; p. 25 (1879).

† Minutes, p. 71 (1879).

	Income, or Deductions. £ s. d.	Expenditure. £ s. d.	£
Brought forward	- -	- -	4,580
Land Meteorology:			
(1.) Observatories and other Stations:			
Amount for six months ending March 1879* - - - - -	12 13 9	1,256 16 8	
Amount for six months ending September 1879† - - - - -	6 12 0	1,224 6 5	
Increment to Superintendent, Valencia -	- -	10 0 0	
		2,491 3 1	
Deduct items of outfit and other exceptional expenses - - -	67 12 8		
		86 18 5	
		2,404 4 8	2,400
(2.) Discussion and reduction of Observations:			
Present salary of 13 clerks, including one vacancy for which 15*s.* a week only is allowed - - - - -	- -	1,432 14 8	1,430
Weather Telegraphy:			
(1.) Telegrams, Storm Warnings, Forecasts, and Reporters, &c.: (Telegraphy and 8h. p.m. Forecasts.)			
Amount for six months ending March 1879* - - - - -	- -	1,764 8 3	
Amount for six months ending September 1879† - - - - -	- -	1,531 6 6	
Add for station at Hawes - -	- -	30 0 0	
Add for extra 6h. p.m. Reports: £			
Cuxham (doubtful) - - —			
Norway (reporters) - - 20			
French telegrams (2) - 120			
English stations (5) - 90			
,, reporters and postmasters 20			
	- -	250 0 0	
		3,575 14 9	
Deduct amount included above for French reports and English stations since 15th June - - (say)	50 0 0		
Repayments, including proportion due (for *telegrams*) at present rate by "Times," &c. - - - -	1,027 12 8		
Deduct items:			
Extra reports, Falmouth - -	15 5 0		
Swiss reports - - - -	7 2 10		
		1,100 0 6	
(Forecasts, except 8h. p.m.)			
Amount for six months ending 30th September† - - - -	165 10 7		
Deduct income ending 30th £ *s.* *d.*			
September† - - 62 4 6			
Deduct for printing presses - 58 1 0			
,, type, &c. - 6 4 5			
,, Harvest telegrams - 62 2 6			
	188 12 5		
Surplus on first six months -	23 1 10		
Estimated at same rate for year -	- -	46 3 8	
(N.B.—Subscriptions are increasing.)			
		‡2,429 10 7	2,420
Carried forward -	- -	- -	£10,830

* Minutes, p. 56 (1878); p. 25 (1879). † Minutes, p. 71 (1879).

‡ No allowance made for changes contemplated by Post Office: (1) as regards our own foreign telegrams; and (2) as regards the "word" tariff for foreign reports generally (both of which will probably affect the Office *unfavourably*), nor for possible changes in the supply of forecasts.

	Income, or Deductions. £ s. d.	Expenditure. £ s. d.	£
Brought forward -	- - -	- -	10,830
(2.) Preparation, Issue, and Discussion of Weather Reports:			
Present salaries of eight clerks -	- -	1,449 3 4	
Repayments, including proportion due (for salaries only) at present rate by "Times," &c. - - -	- -	477 16 0	
		971 7 4	
Amount to be charged against "Research," as per Chairman's memorandum of June 1879 - -	- -	50 0 0	
		921 7 4	920
Inspections:			
Salaries of two inspectors - -	- -	300 0 0	
Expenses for six months to 30th September* - - -	- -	145 3 7	
Outstanding charges (partly estimated)	- -	64 10 0	
		509 13 7	500
Ocean Meteorology:			
Supply of Instruments and other Expenses:			
(1.) Royal Navy:			
Amount for six months ending March 1879† - - - -	- -	120 6 7	
Amount for six months ending September 1879* - - - -	- -	144 0 5	
		264 7 0	
Deduct for special instruments bought by Lieutenant Kitchener - -	- -	32 5 0	
		232 2 0	250
N.B.—There is no comparison between one year's cost and another. The mean of last 10 years' actual payments is 250*l.*			
(2.) Mercantile Marine:			
Amount for six months ending March 1879† - - - -	- -	271 8 11	
Amount for six months ending September 1879* - - - -	- -	413 8 9	
		684 17 8	
Deduct "Wind Area" instrument, Dutch observations, copper-plates, and "Station" barometers - -	- -	180 9 3	
		504 8 5	450
N.B.—Same remark as above. The mean of last 10 years' actual payments is about 450*l.*			
Carried forward - - -	-		£12,950

* Minutes, p. 71 (1879). † Minutes, p. 56 (1878); p. 25 (1879).

	Income, or Deductions. £ s. d.	Expenditure. £ s. d.	£
Brought forward -	- - -	- -	12,950
(3.) Distant Island (or Coast) Stations :			
Caretaker at Bermuda - - - - -		18 5 0	
Observer at Norfolk Island - - - -		5 0 0	
Margin for petty expenses - - - -		6 15 0	
		30 0 0	30
(4.) Reduction and Discussion of Observations and care of Instruments :			
Marine Superintendent - - - -		400 0 0	
Assistant and one writer - - - -		304 0 0	
Present salaries of seven clerks - - -		1,114 16 0	
		1,818 16 0	
Deductions as per Chairman's memorandum of June 1879 :			
Amount to be charged against "Research" for proportion of Mr. Baillie's salary - - - - - -	100 0 0		
Deduct from balance in 1878–9 - -	200 0 0	300 0 0	
		1,518 16 0	1,520
			£14,500

METEOROLOGICAL OFFICE : ESTIMATES for the Year 1880–81.

	Proposed for 1880–81.		Voted for 1879–80.		1880–81. Increase.	1880–81. Decrease.
Administration :	£	£	£	£	£	£
Payment of Council - - -	1,000	- -	1,000			
Secretary - - - - -	800	- -	800			
Salaries and wages - - -	710	- -	710			
Rent, fuel, and lighting - - -	650	- -	560			
Incidental and contingent expenses -	420	- -	330			
		3,580		3,400	180	
Special Researches and Experiments -	- -	1,000	- -	1,000		
Land Meteorology :						
Observatories and stations - - -	2,400	- -	2,400			
Discussion and reduction of observations -	1,430	- -	1,410			
		3,830		3,810	20	
Weather Information and Forecasts :						
Telegraphic reports and storm warnings -	2,420	- -	2,300			
Preparation and issue of Reports and Forecasts - - - - - -	920	- -	900			
		3,340		3,200	140	
Inspections :						
Salaries and travelling expenses - -	- -	500	- -	500		
Ocean Meteorology :						
Discussion and reduction of observations -	1,320	- -	1,390			
Expenses incidental to the supply of instruments :						
Care and issue of instruments -	200	- -	200			
Royal Navy - - - - -	250	- -	500			
Mercantile Marine - - -	450	- -	450			
Distant islands (and coast stations) -	30	- -	50			
		2,250		2,590	- -	340
Totals - - - - -	- -	£14,500	- -	£14,500	£340	£340

The Secretary was instructed to forward the estimate to the Treasury.

SUBMITTED—The following STATEMENT respecting the RECORDS for August 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
Action - - - - - -	Good.	Good.	Good.	Indifferent.	Good.	Good.	Good.	Good.	Good.	Good.	Indifferent.	Good.	Indifferent.	Good.
Records deficient, due to stoppage of clock -	0	0	0	0	0	0	1 hr.	0	0	0	0	0	0	0
,, ,, other causes -	‡1 hr.	‡1 hr.	0	0	*6 hrs.	*7 hrs.	0	0	0	0	0	0	*3 hrs.	*‡9 hrs.
Orientation verified - - - - -	—	—	30th	—	15th	—	2nd & 23rd	—	5th	—	30th	—	7th	—
No. of errors discovered by subsidiaries -	0	0	1	0	0	0	0	0	0	0	0	0	0	0
,, ,, irregular differences	0	1	0	0	0	0	0	1	0	2	0	0	0	5
Result of 40 *Remeasurements*:—														
Greatest difference - - - -	0·0	1·0	1·0	1·0	1·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	1·0	2·0
Mean difference irrespective of sign - -	0·0	0·4	0·1	0·5	0·1	0·5	0·0	0·4	0·0	0·4	0·0	0·4	0·0	0·6
Residual difference (— Meteorological Office) -	0·0	0·0	−0·1	0·0	−0·1	+0·1	0·0	+0·1	0·0	+0·1	0·0	0·0	0·0	+0·1
RAIN GAUGE:—														
Action - - - - - -	Good		Indifferent.		Bad.		Indifferent.		Good.		Good.		Indifferent.	
Records deficient, due to stoppage of clock -	0		0		0		0		0		5 hrs.		0	
,, ,, other causes - -	**11 hrs.		0		0		0		†10 hrs.		0		0	
Errors in tabulation - - - -	0		0		0		0		0		2		0	

BAROGRAPH :—

Action	Good. Indifferent.	Good. Do.	Good. Bad.	Good. Do.	Good. Indifferent.	Good. Do.	Good. Do.
Photography							
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	*1 hr.	0	§2 hrs.	0	0	0	*1 hr.
No. of errors discovered—							
In entry of standard	2	¶ 21	4	4	2	0	0
„ calculating residual correction	0	0	2	5	0	0	1
„ applying residual correction	3	2	0	4	2	1	5
„ subtraction in subsidiary tables	0	0	0	1	1	1	0
„ tabulation by subsidiaries	0	0	0	0	0	2	0
„ „ irregular differences	5	1	3	1	10	0	0
Result of 40 *Remeasurements :—*							
Greatest difference	0·010	0·005	0·007	0·009	0·005	0·008	0·009
Mean difference irrespective of sign	0·0033	0·0029	0·0024	0·0025	0·0021	0·0027	0·0027
Residual difference (—Meteorological Office)	—0·0023	—0·0010	- 0·0007	+0·0011	—0·0002	+0·0010	—0·0008
Mean monthly difference between simultaneous Barograph and Barometer readings	0·0013	0·0027	0·0018	0·0022	0·0025	0·0014	0·0015

THERMOGRAPH :—

Action	††Good. Indifferent.		Good. Do.		Good. ‖Bad.		Good. Indifferent.		Good. Indifferent.		Good. Do.		Good. Do.	
Photography														
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	5 hrs.	hrs.
„ „ imperfectly moistened bulbs	—	0	—	1 hr.	—	26 hrs.	—	4 hrs.	—	0	—	0	—	0
„ „ partially frozen bulbs	—	0	—	0	—	0	—	0	—	0	—	0	—	0
„ „ other causes	*3 hrs.	*3 hrs.	0	0	0	0	0	0	0	0	0	0	*1 hr.	*1 hr.
No. of erorrs discovered in entry of Standard	0	0	0	0	0	1	0	0	2	1	0	0	0	0
„ „ by subsidiary measurements	1	1	0	2	0	0	0	0	0	0	0	1	0	0
„ „ of subtraction in do. tables	0	1	1	0	0	0	1	0	4	0	1	0	0	1
„ „ detected under glass scale	11	4	20	1	1	8	31	8	3	3	0	8	7	5
Result of 40 *Remeasurements :—*														
Greatest difference	0·3	0·3	0·5	0·3	0·3	0·7	0·4	0·3	0·2	0·2	0·2	0·4	0·3	0·3
Mean difference irrespective of sign	0·13	0·12	0·18	0·11	0·11	0·13	0·18	0·10	0·08	0·13	0·08	0·16	0·10	0·09
Residual difference (—Meteorological Office)	—0·05	—0·08	—0·18	+0·05	+0·09	—0·10	+0·18	+0·03	—0·03	+0·06	+0·03	+0·15	+0·02	—0·06
Mean monthly difference between simultaneous Thermograph and Thermometer readings	0·20	0·13	0·16	0·20	0·08	0·10	0·24	0·19	0·15	0·16	0·12	0·15	0·16	0·17
No. of errors in maxima and minima	6	—	10	—	2	—	7	—	4	—	1	—	3	—

* Instrument under inspection or repair. † Funnel choked. ‡ Pencils not lowered. § Bad photography. ‖ Improved at end of month.

¶ Principally due to tenths of degrees of attached thermometer not having been allowed for in correcting for temperature. ** Action of instrument unreliable. †† Clock-stop acted badly for some time.

SUBMITTED—The following STATEMENT respecting the RECORDS for September 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

——	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :— Action	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Indifferent.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.
Records deficient, due to stoppage of clock	0	0	0	0	0	9 hrs.	0	0	0	0	0	0	0	0
„ „ other causes	0	0	*1 hr.	*3 hrs.	0	0	0	0	0	0	*†16 hrs.	*†25 hrs.	*†29 hrs.	*†47 hrs.
Orientation verified	—	—	4th	—	16th	—	30th	—	2nd	—	8th&15th	—	6th	—
No. of errors discovered by subsidiaries	0	0	0	0	2	0	0	0	0	1	1	0	0	0
„ „ irregular differences	0	1	0	0	11	2	1	2	0	0	0	0	0	10
Result of 40 *Remeasurements* :—														
Greatest difference	2·0	1·0	1·0	1·0	1·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	0·0	3·0
Mean difference irrespective of sign	0·1	0·4	0·0	0·3	0·0	0·6	0·0	0·4	0·0	0·4	0·0	0·4	0·0	1·0
Residual difference (— Meteorological Office)	+0·1	0·0	0·0	−0·1	0·0	0·0	0·0	+0·1	0·0	−0·1	0·0	0·0	0·0	+0·1
RAIN GAUGE :— Action	Good.		Good.		Bad.		Indifferent.		Good.		Good.		Good.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		0		0		‡22 hrs.	
Errors in tabulation	0		4		0		0		2		3		6	

BAROGRAPH :—													
Action	Good. Indifferent.		Good. Do.		Good. Indifferent.		Good. Do.		Good. Do.		Good Do.		Good. Do.	
Photography														
Records deficient, due to stoppage of clock	0		0		7 hrs.		0		0		0		0	
„ „ failure of light	0		0		0		0		0		0		0	
„ „ other causes	0		0		§3 hrs.		0		0		*4 hrs.		§48 hrs.	
No. of errors discovered—														
In entry of standard	0		0		2		3		1		0		0	
„ calculating residual correction	0		0		3		2		3		0		0	
„ applying residual correction	0		0		0		0		4		0		7	
„ subtraction in subsidiary tables	0		0		1		0		0		0		0	
„ tabulation by subsidiaries	0		0		0		0		0		0		0	
„ „ irregular differences	0		0		2		0		0		0		1	
Result of 40 *Remeasurements* :—														
Greatest difference	0·005		0·005		0·010		0·005		0·005		0·008		0·007	
Mean difference irrespective of sign	0·0024		0·0024		0·0036		0·0025		0·0018		0·0024		0·0022	
Residual difference (— Meteorological Office)	−0·0003		−0·0003		+0·0012		−0·0002		+0·0004		+0·0002		+0·0010	
Mean monthly difference between simultaneous barograph and barometer readings	0·0017		0·0023		0·0012		0·0024		0·0017		0·0025		0·0014	
THERMOGRAPH :—														
Action	Good. Do.		Good. Do.		Good. Do.		Good. Do.		Good. Do.		Good. Do.		Good. Indifferent.	
Photography														
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	19 hrs.	10 hrs.	0
„ „ imperfectly moistened bulbs	—	0	—	1 hr.	—	8 hrs.	—	0	—	1 hr.	—	0	—	0
„ „ partially frozen bulbs	—	0	—	0	—	0	—	0	—	0	—	0	—	0
„ „ other causes	0	0	‖18 hrs.	‖23 hrs.	0	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	0	0	0	2	0	0	1	0	0	1	1
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	1	1	0	0	2	1	0	0	2	0	1	0	1
„ „ detected under glass scale	4	3	9	3	2	4	18	4	4	5	0	2	0	7
Result of 40 *Remeasurements* :—														
Greatest difference	0·3	0·3	0·4	0·3	0·3	0·4	0·3	0·2	0·3	0·3	0·4	0·3	0·2	0·4
Mean difference irrespective of sign	0·07	0·08	0·16	0·11	0·12	0·12	0·16	0·09	0·11	0·09	0·08	0·11	0·11	0·13
Residual difference (— Meteorological Office)	−0·05	−0·05	−0·15	+0·06	+0·10	−0·09	+0·14	+0·01	−0·09	+0·03	−0·04	0·0	+0·06	−0·12
Mean monthly difference between simultaneous thermograph and thermometer readings	0·21	0·16	0·12	0·16	0·07	0·10	0·21	0·20	0·15	0·16	0·12	0·13	0·20	0·12
No. of errors in maxima and minima	4	—	3	—	3	—	7	—	3	—	1	—	4	—

* Instrument under inspection. † Pencils not lowered. ‡ Pipe leaking. § Bad photography. ‖ Clock stopped through faulty action of light-shutter.

Mr. Galton and Gen. Strachey reported that they had examined van Rysselberghe's Meteorograph, which had been constructed for the Indian Meteorological Department: that its cost was 200*l.*, and that it appeared to them to work satisfactorily.

The instrument gives a graphical representation on plates, from which impressions can be taken, but it would require considerable additions to enable it to register by type printing.

Reported—That Mr. Darwin's Hydraulic Meteorograph (Minutes, 1878, p, 44) had been erected at the Office on the 10th instant.

Resolved—That a letter (No. 3141) be written to Mr. Darwin, stating that the Council do not see any immediate probability of using his instrument, and therefore place at it his disposal.

The Chairman stated that he had learnt that Mr. Stone, F.R.S., Radcliffe Observer, would be glad if he could obtain the use for a time of the spare outfit of a self-recording observatory belonging to the Office.

Resolved—That the instruments be lent for a year, with an explanation of the circumstances under which the Council might find it necessary to recall them, but that if not required the loan might be renewed.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting seven logs had been received, two of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last Mention on Minutes.
Capt. C. D. Coxwell, assisted by Mr. R. Ladd.	SS. "German" -	Sept. 12—Dec. 1, 1879.	Table Bay, &c. - -	1879, p. 7.
Capt. J. Metcalfe -	SS. "Oceanic" -	Feb. 15—Dec. 2, 1879.	San Francisco to China and Japan (three voyages).	1879, p. 61.

Mr. Scott was instructed to convey the best thanks of the Council to the above gentlemen.

The Secretary submitted specimens of pressure charts for the globe and of cloud pictures for Mr. Ley's work "Aids to the Study and Forecast of Weather" (p. 49).

Resolved—That a shaded pressure chart be adopted, and that Mr. Ley be requested to submit six typical forms of cloud, to be reproduced in high-class lithography, and to be of such a size as to go on one page, royal 8vo.

It was resolved that the issue of the lithographed Weekly Summary of the Daily Weather Report be discontinued at the end of the year, and that copies of the Weekly Weather Report be issued to subscribers instead, printed on sheets of the same size as the present lithographed summary.

November 29th, 1879.

STATEMENT of WORK done in PANTAGRAPH ROOM during NOVEMBER.

Seven Copper Plates have been engraved, viz.: Plates 33–37, 1876. Plates 43–44, 1879.

Zinc Plates.—Barograms, 5 plates, Nos. 38–39, 1876, and Nos. 43–45, 1879. Thermograms, 6 plates, Nos. 43–48, 1879. Anemograms, 7 plates, Nos. 34–39, 1876, and No. 44, 1879. Rain Curves, 10 plates, Nos. 33–40, 1876, and Nos. 43–44, 1879. Vapour Tension, 2 plates, Nos. 43–44, 1879.

The *Photographic Curves* are not ruled in advance of the zinc plates pantagraphed, Mr. Cobley's absence on sick leave has brought this part of the work almost to a standstill.

The *August* tabulations, having been examined and the "Remark Sheets" written, were passed to the Computing Room on the 5th. The *September* papers were received from Mr. Allen on the 21st, and are now in hand. Mr. Allen's report is attached.

(Signed) R. H. CURTIS.

R. H. Scott, Esq., F.R.S.

November 28th, 1879.

STATEMENT of WORK done in EXAMINATION ROOM during NOVEMBER 1879.

Examination of the curves and tabulations for—

September.—Completed.

October.—Thermograms for Valencia, Armagh and Glasgow completed. The remaining stations are now in hand. Barograms for Valencia and Armagh partly examined.

To R. H. Scott, Esq., (Signed) T. E. ALLEN.
Secretary, Meteorological Council.

STATEMENT of WORK done in MARINE ROOM during NOVEMBER 1879.

December 1879.

Examined six new logs, and three lighthouse registers.

Cape of Good Hope District.

Winds.—January revised wind-roses, prepared according to method directed by Mr. Galton.

Air Temperature.—January meaned and charted for single-degree squares.
January and July range obtained and charted.

Currents.—General current-lines drawn for July.
Individual currents charted for February and March.

Sea Surface Temperature.—Noon observations charted for January, April, and October.
Obtaining and charting July means and range for single-degree squares, drawing isotherms of mean and extremes.

Cape Gales.—October gales tabulated.
Grouping July gales and obtaining mean results, also drawing diagrams to illustrate the discussion of data.

Collection of Data for Indian Government.

Considerable progress made in preparing a duplicate copy of data by outside assistance, the supervision being done by ordinary staff.

(Signed) CHARLES HARDING.
HENRY TOYNBEE,
Marine Superintendent.

Reported—That cheques had been drawn:

For R. W. Munro, on account, for Harmonic Analyser -	- £100	0	0
For H. Darwin, for Meteorograph (Minutes, 1878, p. 44)	- 25	0	0

The Council then adjourned.

116, *Victoria Street, December* 20, 1879.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | PROFESSOR STOKES.
MR. GALTON. | GENERAL STRACHEY.
THE HYDROGRAPHER.

The Secretary was in attendance.

Reported—That a letter (No. 3152) had been written to Mr. Stone on the subject of the proposed loan of instruments to the Radcliffe Observatory (Minutes, Dec. 13), and that Mr. Stone had replied (Letter 3076), proposing the following conditions: 1. That the loan of the instruments be for one year certain. 2. That there be a reasonable expectation of a continuance of the loan after the end of the year.

Resolved—That the instruments be lent for one year certain on condition of the results being sent to the Office for use, if required, with leave to Mr. Stone, if he should think fit, to apply for a continuance of the loan.

Submitted—Some results for the year 1870 obtained by Mr. R. Curtis with the Harmonic Analyser. The Secretary was instructed to have the work repeated for January and February 1877, which had been already done by Mr. C. Harding with the model of the instrument (Letter 1187, 1878; Minutes, 1878, p. 37).

Reported—That Mr. H. Darwin had written (Letter 3071) to say that he would inform the Council of the performance of his apparatus for measuring the chemical effect of total daylight when he had tested its action for a longer time (Minutes, Nov. 20).

Submitted—A specimen form of the Quarterly Summary of Temperature and Rainfall for the United Kingdom (Minutes, pp. 41, 46), which was generally approved, but ordered to be re-submitted with the addition of a list of the stations employed, showing the changes made in them during the fifteen years comprised in the summary.

Submitted—A draft scheme for the text of the Quarterly Weather Report (Minutes, 1878, p. 97), which was generally approved, but ordered to be re-submitted with some corrections in detail.

Submitted—The Report of the International Congress of Meteorology held at Rome in April (Minutes, p. 72). The Secretary was instructed to forward a copy officially to the Foreign Office.

The memorandum of Mr. Galton on a new method of discussing Wind Roses (Minutes, p. 53), was ordered to be placed on the Minutes.

Submitted—Specimens of the several charts embodying the results of the work of the Marine Department upon the Cape Squares. It was resolved—

I. That there be drawn and lithographed on the July Current Chart—(*a.*) The sea isotherms already prepared from the means for single-degree squares, after revision and comparison with the plotted noon observations. (*b.*) The principal physical features of the part of Africa comprised in the chart.

II. That areas of approximately equal range of temperature be shown on the current chart by stippling.

III. That currents, in two colours, be drawn on the lithographed chart and submitted for approval.

IV. That the charts of sea isotherms (Minutes, Nov. 29) be proceeded with, the four months of January, April, July, and October to be finished first.

V. That the plotted noon sea temperature observations (see Minutes, p. 73) be lithographed for the same four months, but only for these.

VI. That the air temperature and barometer charts (Minutes, Nov. 29) be proceeded with; the same four months to be finished first.

VII. That the wind-roses for August be lithographed instead of being engraved on copper; the Minute of March 21 (Minute, 1878, p. 135) being revoked.

VIII. That a wind-rose chart for January be drawn, with :—(*a.*) Wind-stars derived from the petal map, described in Mr. Galton's memorandum; (*b.*) Air isotherms and isobars (in colours); and (*c.*) any further air temperature or barometer indications that may seem desirable. The whole to be in such a form as may be suitable for publication.

The Chairman and Mr. Galton were requested to give any supplementary instructions that might be needed with regard to the foregoing resolutions.

Read—A memorandum from Captain Toynbee reporting that since the last meeting three logs had been received, one of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. R. H. Napier, R.N.	H.M.S. "Magpie"	Nov. 1, 1878—Apl. 30, 1879.	Surveying in China Seas	1878, p. 135.

Mr. Scott was instructed to convey the best thanks of the Council to Captain Napier.

Captain Abney was re-appointed photographic adviser for another year, on the same terms as heretofore (Minutes, 1878, p. 77).

Read—A letter from Mr. Cullum (No. 2913) submitting an estimate for repairs at Valencia (p. 78), amounting to 55*l.* 7*s.* 6*d.* The Secretary was authorised to accept this estimate.

Read—A letter (No. 2919) from Professor Grant of Glasgow, stating that his clocks had been repaired (Minutes, p. 75).

Resolved—That a bonus of 3*l.* 3*s.* be given to the telegraphic reporters on the same conditions as in 1878 (Minutes, 1878, p. 22).

Submitted—A copy of the newly-issued "Bolletino Meteorico dell' Ufficio Centrale di Meteorologia, Roma," commencing November 30.

The Council then adjourned, the next two meetings being fixed for January 10 and 24, 1880.

A

NEW METHOD OF DISCUSSING WIND-ROSES.

BY FRANCIS GALTON.

OCTOBER 3, 1879

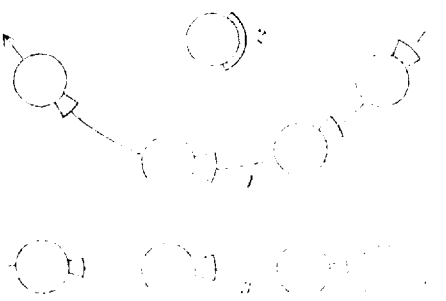
WITH TABLES AND CHART.

HEREWITH I beg to submit the results of an examination of the wind-rose sheets of the six Cape squares for the month of April. They are fully confirmed by a cursory review of the more recently engraved charts for January, July, and October.

I may first mention that the "area" wind-roses prove to be of as much assistance as I had hoped; they tell their story very clearly, and so far as wind frequency is concerned I do not see how they could be improved upon either in form or in distribution. The stars, crosses, or absence of any mark in their centre, which divide them into broadly-marked grades according to the number of included observations, were found very convenient.

As soon as we have become familiar with these charts we are impressed with the fact that the details of individual roses, as distinguished from their general appearance, are untrustworthy. The disagreement of neighbouring roses is too great to make it reasonable to believe that the minor peculiarities express constant characteristics of the regions to which they refer, and are not merely the result of chance.* On the other hand, we find that the wind-roses generally concur in indicating the existence of certain prevalent wind-systems that manifest themselves in bold curves across the entire chart. Their appearance is a graphical representation of such verbal generalisations as "Westerly winds prevail on the left side of the chart, and gradually become W.S.W. towards the upper right-hand corner of it." It seems to me that the trustworthiness of these general appearances, to which almost every wind-rose contributes its quota, is much superior to that of any results obtainable from individual roses, or even from the combination of a group of neighbouring roses. I shall show that it is both possible and easy to utilise in our numerical calculations this new but paramount element of General Appearance, and that the discussion of wind-data ought to be carried on upon quite a different principle to that hitherto adopted.

In order to give a first general notion of my method, I would direct attention to the remarkable wind-system in the April chart (see Table V.), that is found to sweep from the Indian Ocean round the promontory of the Cape up to the Trade Winds of the Atlantic, and which, I may add, is by no means peculiar to that month. The "petals," so to speak, of the wind-roses that refer to this particular system are disposed in a curve, in the manner very roughly shown in Fig. 1. They are of much the same shape, though no two of them are turned towards the same point of the compass. If we sum and average these petals in the usual way, we obtain a spread-out figure, Fig. 2, that bears no resemblance whatever to the petals themselves, whereas if we detach them and lay them with their axes all pointing the same way, Fig. 3, and so take their average, we shall obtain a figure that is the best attainable



* This conclusion is amply confirmed by purely theoretical considerations.

likeness of the petals in themselves; that is to say, independently of their position. Then we can place this revised petal on any part of the wind-system we please, and adjust its axis to coincide with the direction of the wind-system at that spot. When we know the number of petals that a wind-rose at a given spot must have, and the shapes of the petals, the bearings of their axes, and their respective areas, we possess all the requisite data wherewith to construct the rose.

I have discussed the April charts on a method based upon the general idea expressed in these remarks. I found the results to be very satisfactory and easy to be arrived at when the calculations were carried on with as few figures as a sound theory appears to require. It will be seen that I do not even use per-centages, but limit myself to per-tenths and half-tenths, which latter I find to be the most convenient unit. On the other hand, in extracting data from the charts that refer to direction, I find the division of the compass into thirty-two points to be too coarse, and I work to half-points.

Description of the process:—

We are supposed to be provided with a wind-rose chart (see Table V., which contains a portion of one of them), and with the numerical data from which the wind-roses were constructed. Each set of the latter is supposed to have been reduced to per-centages, and entered in the usual way on one of the working forms (see Table I., in which the top line shows the points of the compass, and the second line gives in very rough per-centages the number of times that winds were observed to blow from each of the points).

We have now to explain the method of revising these tabular data by the help of the chart, so as to enable us to draw revised roses that shall accord with the broad features of the chart as a whole, and shall harmonise together. Also we have to show how new roses may be drawn in intermediate positions. The method of revision is by no means so complicated in reality as it may appear from the necessarily prolix description, while that of interpolation is peculiarly simple and swift.

(1.) After making a careful study of the chart, draw lines with a pencil along the courses of the wind-systems, tentatively and lightly at first, but afterwards with decision. When they are satisfactorily made out, allot distinctive letters and colours to each of them.

In the April charts there are four such tracks, which are distinguished in the diagram by the letters *g y b* and *r*, and which in my working drawings were coloured green, yellow, blue, and red respectively. A sufficient portion of the chart is given in Table V. to afford evidence of the *g* system and in some degree of the *r* system, but the others are more fully developed in the part of the chart that is not given there.

The accompanying sketch shows the disposition of these four systems, and the dotted outline indicates the portion of the chart that is reproduced in

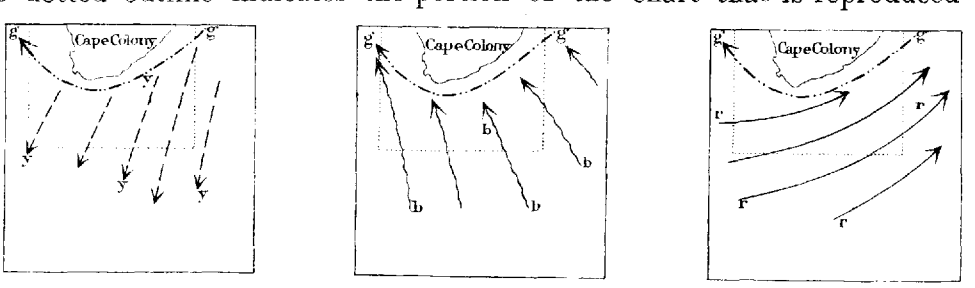


Table V. Of *g* I have already spoken as sweeping round the Cape from the Indian Ocean to the trade winds of the Atlantic; *y* is an offshoot of it, diverging from the Indian Ocean to the south; *b* is an affluent which comes to it from the south and joins the Atlantic trades, and *r* is a broad system of W. and W.S.W. winds.

(2.) Measure to the nearest half-point and note in pencil the bearings of the several wind-systems as they pass through the centres of the several roses.

(3.) Leaving aside the chart and turning to the numerical tables (see Table I.), allot one of the lines below that which contains the per-centages to each of the wind-systems, writing at its side the distinctive letter and placing asterisks in pencil at the points of the compass determined by the measurements described in the last paragraph. An additional line is allotted to

"Unclassified," and another is used for "Calms." When the asterisk falls upon a half-point, it is placed on the line that divides two columns (as in the line *g* in Table I. A.).

(4.) If the wind-systems have been drawn true to nature, the figures in the top line that stand vertically above the asterisks will be larger than those on either side of them. In other words, the axis of each assumed petal is, as it should be, longer than any other of its rays. This I found generally to be the case even on a first trial, but it was advisable in not a few instances to revise the position of the asterisks, and occasionally to reconsider the direction of the wind-systems at the less well-marked parts of their curves. Guided by the run of the figures in the tables, I allowed myself full liberty to revise the position of the asterisks to the extent of half a point, and sometimes when the evidence was strong to a point or even more. Then the pencil asterisk was rubbed out and an inked or coloured one was inserted in the new place; the revised bearing was drawn in colour on the chart, and the wind-systems themselves were drawn in colour under the joint guidance of the old pencil lines and the revised bearings.

(5.) The next step is to obtain the mean shape of each of the petals, In about one half of the data the asterisk falls upon one of the points of the compass; we will distingnish these as V case. In the remainder it falls half-way between two points; we will call these W cases. We have to treat the V and W cases separately, and to combine the results. It will be sufficient to describe the process for the former, and for one set of petals, say those of the *r* system in table in Table I. A sheet of paper is ruled with horizontal lines and vertical columns, and an asterisk is placed at the top of the middle column. The numerical data that correspond to the *r* petal in each rose are successively entered on this sheet in such a way that the figure which corresponds to the *r* asterisk (as the figure 6 does in Table I. A.) shall always occupy the middle column, five or six other figures being arranged in their tabular order on either side of it. The points of the compass are entirely disregarded in this stage of the proceedings, because we are merely concerned with the shape of the petal, and not with its position as a whole. While entering the figures the judgment has often to be exercised in dissecting, as it were, two petals that overlap one another; still, on the whole, the proceeding is straightforward and easy. It will be found in the several lines, and still more so in the sum of them, that the figures have a strong tendency to dwindle to zero at a few points on either side of the asterisk, and the extreme average breadth of the petal is determined by the average distance of these zeros from the asterisk. It varies little, so far as I have hitherto observed, in the petals of the same system, but it is different in different petals.

The W cases are treated on precisely the same general principle as the V. The sheet is ruled as before, but the asterisk is now drawn on one of the middlemost vertical *lines*.

We have lastly to combine the V and W results, and the simplest way of doing this is to plot separate curves from them and to draw by eye with a free hand a smoothed mean of the two.

I took considerable pains at first to learn the exact shape of the petal in the different cases, and whether it varied in different parts of the same wind-system. But this was wasted labour, except so far as it incidentally gave me a truer appreciation than I had before of the character of the materials to be dealt with, and the degree of delicacy with which they ought to be manipulated. I soon found that the rude methods I now adopt are as efficacious in their results as any other. A little consideration is sufficient to show that when we limit ourselves to per-centages in simple integers, that is to 100 units to express the shape of an entire wind-rose, or say 30 units to express the shape of a single petal extending over seven points of the compass, it is as much out of the question to represent the real delicacy of the outline of the petal as it is to embroider a leaf true to nature with only 30 stitches of tapestry work. The 30 units have to be so distributed that they shall be most numerous along the axis of the leaf, and shall dwindle to 1 or to zero at either of its margins. Under these restrictions the number of possible arrangements is small, and although I work to half units it seems improbable that more than a dozen different forms of petal will ever be required. Three suffice for the April chart, except for the extreme N.W.

corner of it, where the Trade Winds begin. It must be recollected that each of these petals has to be numerically expressed in two forms, the one for the V cases where the axis corresponds to one of the points of the compass, the other for the W cases where it corresponds to a half point. Finally, unsymmetrical petals would be dealt with by taking one half of them from one system and the other half from another.

In Table II. the numerical data are given that correspond respectively to the V and W cases of each of the three forms of petal observed in the April chart and for all the sizes of petal with which we have to deal. The column of Roman numerals headed "Multiplier" refers to the degree of frequency expressed in *tens* per cent. with which winds are observed to blow somewhere within the range of the petal. Thus I. stands for 10 per cent. of frequency, II. for 20 per cent. The numbers in the same line show how this 10 per cent., 20 per cent., or whatever it may be, is distributed. For example, required the numerical data for a *b* petal in a V case when the frequency of wind somewhere within that petal is 30 per cent. We look on the V side of of the *b* tables for the line III. and find there that the frequency at the point of the compass where the axis of the petal lies is 5 per cent., and that the frequency at the successively adjacent points of the compass on either side of it, viz., $4\frac{1}{2}$, 4, 3, 1. The sum of the entire line in the table, viz., of 1, 3, 4, $4\frac{1}{2}$, 5, $4\frac{1}{2}$, 4, 3, 1, is 30, as it should be.

(6.) The next step is to compile a diagram chart like Table IV., in which the number of lines and dots on different parts of the little circles show the relative frequency of wind in the corresponding petals. The total frequency is here taken as 10 units and not as 100. Each line stands for a unit and therefore for one tenth of frequency, and each dot stands for a half-tenth. (I find it much more convenient to work with this notation than with 10 per cents. and 5 per cents.) The data for the lines and dots are obtained from the right hand vertical column in Table I. A. In the first instance, I confine my work to the roses with stars in their centres, that is to the most trustworthy class of them, and I proceed by entering in each case the tabular data *diminished by one half unit.* The reason for this is that I reserve full liberty of revision to the extent of one half unit, so that when the first data are protracted I have never to erase, but can add a dot or a line wherever I please to make the adjacent roses harmonise, and to raise the number of entries in each rose (including calms and unclassified) up to an even 10.

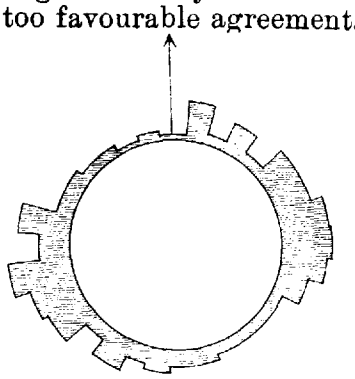
I gradually include the roses with crosses in their centres, that is those of the second order of trustworthiness. In these I allow myself full liberty of revision to the extent of one unit in each petal. I find this trifling and limited amount of "cookery" quite sufficient on the whole to make the wind-roses harmonise. It is not at all difficult to arrive at this harmonious result even though many systems have to be considered at the same time. If, however, instead of working with tenths and half-tenths, I employ percentages, the difficulty becomes serious. The results of the revision are noted as in Table I. B. I do not care to use the roses that have no central mark, which are of the lowest order of trustworthiness, being compiled from less than 50 observations, except to learn that the conditions which obtain in their neighbourhood are not altogether anomalous. They are left unrevised in Table III.

(7.) The pictorial data in Table IV. are now transferred to a numerical table, as in Table V., though if Table IV. had been drawn on a larger scale and the circles had been divided into points of the compass, this step would be unnecessary.

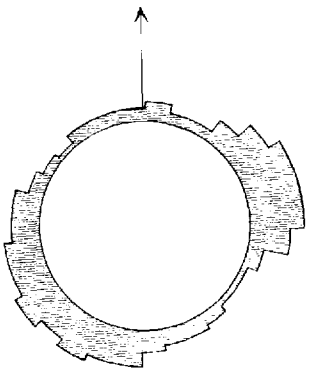
This completes the procedure. I will now show how readily the results can be turned to account, either in revising one of the original roses or in drawing a new one at any required spot on the chart. Suppose we wish to revise one of the roses, say 441 B. (see Table I. B.); we turn to Table II. which contains the numerical values to which the various terms used in Table I. are the equivalents. Thus for *g* iii$\frac{1}{2}$, we add by eye the lines corresponding to iii. and to $\frac{1}{2}$, in the proper *g* compartment of Table II. and enter them in Table I. under the guidance of the asterisk; similarly for *y* i, *b* ii, and *r* iii$\frac{1}{2}$. Then we add the lines together. There are several half units in the result; these are successively counted as zero and as 1, and so we obtain the bottom line

of the table, the sum of the units in which is necessarily equal to 100, from the conditions of its construction.

The rose from observed data is shown in Fig. 1, the calculated rose is shown in Fig. 2. I may add that I have purposely avoided the selection of a case of too favourable agreement.



1. *From observed data.*



2. *From revised data.*

Under their revised form the wind-roses retain as close a resemblance as we can expect to the original ones. At the same time they have a much more important characteristic than close similarity in details, namely, that of harmony with their neighbours in producing the appearance of those wind-systems whose existence is the most trustworthy fact presented by the wind-chart.

The interpolation of new wind-roses that shall express the conditions prevalent at the locality where they are placed is a matter of equal facility. A circle is drawn on Table IV. at the required spot, the lines and dots are interpolated and so are the bearings of the wind-systems at that place, and the calculation proceeds as just described.

Calms may be indicated by a line or dot in the centre of the circle, and some place must be found for the "unclassified," but these are insignificant in number in the April chart except in the extreme S. portion of it, where some E. winds are felt. These would have to be noted.

The wind systems do not necessarily testify to the existence of actual winds blowing right across the area represented in the chart, and it is by no means necessary to the trustworthiness of my method that they should do so. It is sufficient that from some cause or other an unmistakable pattern should exist in the wind-rose chart, and that some such pattern will always be found on a careful examination seems the necessary result of what we know from other sources of the large scale of meteorological phenomena generally, of the way in which depressions are apt to pursue the same or neighbouring tracks, and of the frequent persistence of areas of elevation in the same localities at the same seasons of the year.

These wind systems have escaped the attention they deserve, owing to the artificial manner in which the wind-data have hitherto been combined in charts. It is only by plotting individual observations when they are few, or by throwing them into numerous small neighbouring wind-roses when they are many, that it is possible to bring out the real effect. The practice of averaging all the wind observations that are scattered over a large area, bounded by lines of latitude and longitude and not by any natural meteorological frontier, seems to mask the very data from which sound deductions can alone be made.

I therefore confidently expect to find wind systems in every chart that may hereafter be made on the plan now adopted by the Meteorological Office. If in any case none should be found, that is to say, if all the observations have to be entered under the head "unclassified," the only legitimate conclusion to be drawn is that the winds have in that case no prevailing tendency, and that a wind-frequency map would be superfluous, for if it were made all its roses would be simply rings.

FRANCIS GALTON.

Supplementary Remarks to "A New Method of discussing Wind-Roses."

In my memoir on a "New Method of discussing Wind-Roses," I explained that the number of possible forms of petals that differed sufficiently to be distinguishable by the eye would not probably exceed a dozen, and further trials have confirmed that view. It therefore seemed well to prepare sets of petals in readiness for use; and rather than adopting the forms that happened first to come to hand, I have calculated theoretical ones from the formula of the well-known law of frequency of error, $y = \frac{h}{\sqrt{\pi}} \epsilon^{-h^2 x^2}$, or rather from the tables based upon that law which are found in works on Probability. In the set of curves that I have calculated, different values of h were taken such as should correspond to a sequence of cases in which the area of the petal being always equal to 100, the area of that part of it which falls within one point of either side of its axis was equal to 10, 12, 14, 16, &c. Taking, for example, a petal in which the part just described is equal to 26, the distribution of the winds in that petal will be as follows:—

Beyond three Points.	Between two and three Points.	Between one and two Points to the left of the Axis.	Between the Axis and one Point to the left of it.	Between the Axis and one Point to the right of it.	Between one and two Points to the right of the Axis.	Between two and three Points.	Beyond three Points.
1	7	16	26	26	16	7	1

It has been found thus far on trial that the form of the petals given by observation accords very well with one or other of these theoretical systems, as we should on *à priori* grounds have anticipated.

A dozen or so different forms of petal, each having the area of 100, being thus calculated, it then became necessary to deduce a set of each form, the area of these being severally equal to 5, 10, 15, &c., corresponding to the half-tenths, tenths, one-and-a-half tenths, &c., spoken of in the memoir. This was readily done, and some of the results have been protracted by the wind-rose machine on cards. The steps in the petals protracted in this way, were then smoothed by a line drawn through them with a free hand, and the smoothed petals were cut out. Thus provided, it has become a matter of extreme simplicity and quickness to draw a revised wind-rose. The proper card is laid on the chart with its axis pointing in the direction of the wind system, a pencil is passed round it and the outline of the petal is drawn in a moment. In completing a wind-rose, wherever two petals overlap, an exterior line has to be drawn whose enclosed area is equal to that of the two superimposed areas. It is hardly necessary to describe this part of the process.

January 2nd, 1880. FRANCIS GALTON.

O 20. 100.—1 80. Wt. 9288. E. & S.

The asterisks shew the medium direction of the several Wind Systems, learnt through a previous study of the Wind Rose Chart.

441. B.	N.	1	2	3	4	5	6	7	E.	7	6	5	4	3	2	1	S.	1	2	3	4	5	6	7	W.	7	6	5	4	3	2	1	Frequency	
Observ.ns reduced roughly to per centages.		5	1	4	1	5	5	6	7	6	4	1	1	1	1	2	2	3	2	4	2	5	6	9	4	7	2	2	1	1		1	per cent.	per ten.
Wind Systems. *g*					1	5	5	6*	7	6	4	1																					35	III½
y		5*	1	4																										1		1	11	I
b													1	1	1	2*	2	3	2	2													14	I½
r																				2	2	5	6*	9	4	7							35	III½
Unclassed.																											2	2	1				5	½
Calms.																																	5	½
																																	105	X½

(A)

The results given in the last column may be written out as follows (see Table III)

(441. B.) — *g*, N 7½ E, III½; *y*, N 1 E, I; *b*, S 1 E I; *r*, S 6 W, III½; *U* ½. *C* ½.

After revision & comparison this was changed to *g*, N 7 E, III½; *y*, N 1½ E, I; *b*, S 1 E, II; *r*, S 6 W, III½.

Example to shew how the latter formula is translated into numbers. [*See Table for drawing Petals.*]

III½ *g*					2	5	7	7*	7	5	2																						III½ *g*
I *y*	1	1½	1½	1	1	1	½																						½	1	1		I *y*
II *b*														1	2	2	3	4*	3	2	2	1											II *b*
III½ *r*																		1	2½	3½	3½	4½	5*	4½	3½	3½	2½	1					III½ *r*
Sum	1	1½	1½	1	3	5	7½	7	7	5	2			1	2	2	3	5	5½	5½	5½	5½	5	4½	3½	3½	2½	1					*Total. 100*
or omitting fractions.	1	2	1	1	3	5	7	7	7	5	2			1	2	2	3	5	5	6	5	6	5	5	4	4	2	1		1	1	1	*100*

(B)

DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

Wind System.	Multiplier	V When axis of petal is directed to one of the points of the Compass.													W When axis of petal is directed to a half point.												Multiplier
g.	I				1	1	2	2	2	1	1							1	2	2	2	2	1					I
	II				1	3	4	4	4	3	1						½	2	3½	4	4	3½	2	½				II
	III				2	4	6	6	6	4	2						½	3½	5	6	6	5	3½	½				III
	IV				2½	5½	8	8	8	5½	2½						1	4	7	8	8	7	4	1				IV
	V				3	7	10	10	10	7	3						1	5½	8½	10	10	8½	5½	1				V
	½					½	1	1	1	½								½	1	1	1	1	½					½
y & r.	I			1	1	1	1	2	1	1	1	1					½	1	1	1	1½	1½	1	1	1	½			I
	II		1	1	2	2	2	2	2	2	2	1	1			½	1	1½	2	2	2½	2½	2	2	1½	1	½		II
	III		1	2	3	3	4	4	4	3	3	2	1			½	1½	2½	3½	3½	3½	3½	3½	3½	2½	1½	½		III
	IV		2	3	4	4	4½	5	4½	4	4	3	2			1	2	3	4½	4½	5	5	4½	4½	3	2	1		IV
	V		2	3½	5	5½	6	6	6	5½	5	3½	2			1	2½	4	5½	6	6	6	6	5½	4	2½	1		V
	½			½	½	½	½	1	½	½	½	½					½	½	½	½	½	½	½	½	½	½			½
b.	I			½	1	1	1½	2	1½	1	1	½						1	1	1½	1½	1½	1½	1	1				I
	II			1	2	2	3	4	3	2	2	1					½	1½	2	3	3	3	3	2	1½	½			II
	III			1	3	4	4½	5	4½	4	3	1					1	2	3	4	5	5	4	3	2	1			III
	IV			1½	4	5	6	7	5	5	4	1½					1	3	4½	5½	6	6	5½	4½	3	1			IV
	V			2	4½	6½	9	8	6½	6½	4½	2					1	3½	5½	7	8	8	7	5½	3½	1			V
	½					½	1	2	1	½								½	½	½	1	1	½	½	½				½

DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

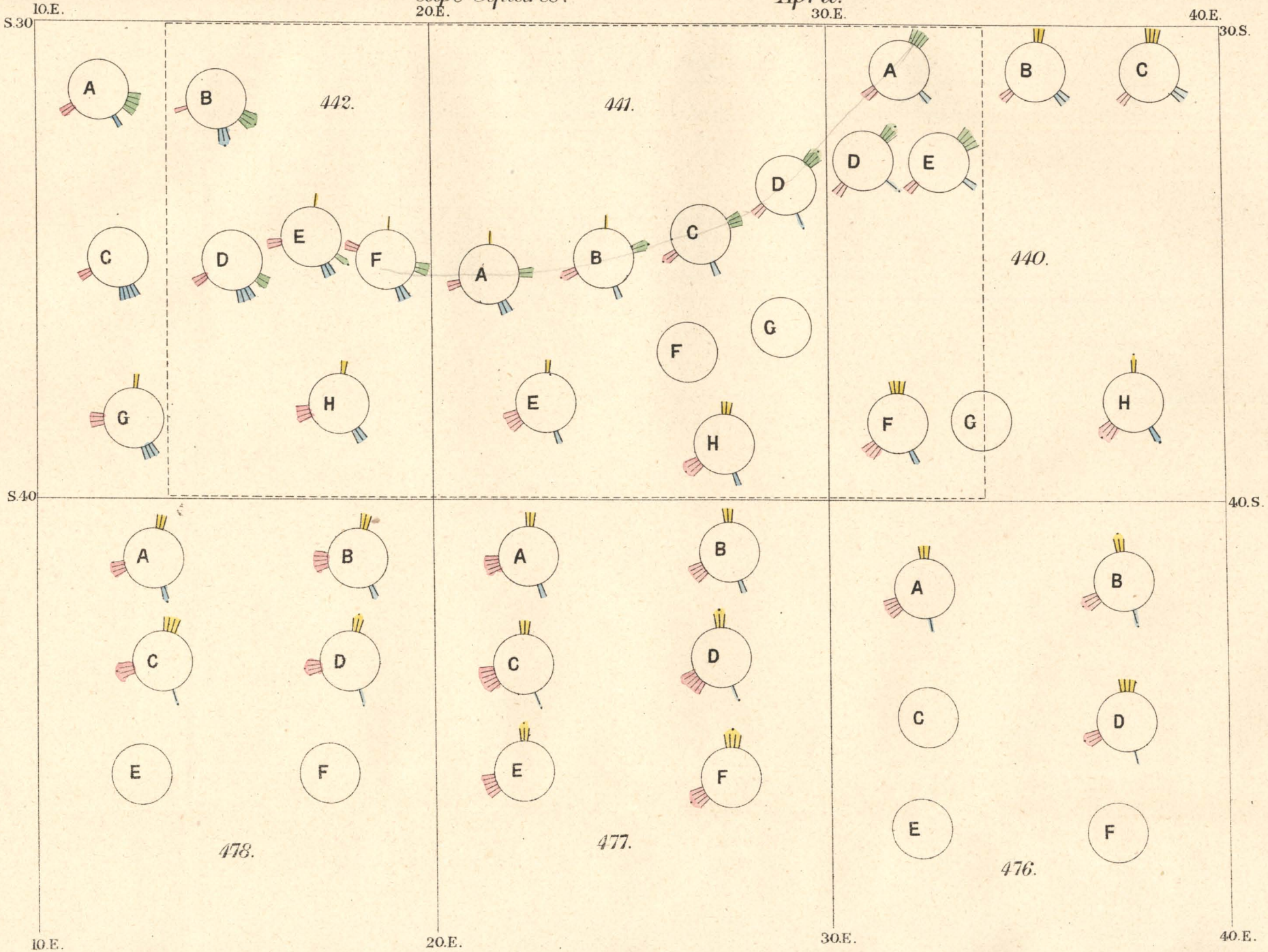
Square	Wind rose	g.	y.	b.	r.	Calms.	Unclassed.
440.	A	N 4 E V		S 6 E II	S 3 W III		
	B		N 1 E III	S 6 E III	S 1½ W III		I
	C		N 1 E IV	S 6 E III	S ½ W III		
	D	N 4½ E IV½	N 3 E ½	S 6 E 1½	S 3 W III		½
	E	N 4½ E V		S 6 E II	S 3 W III		
	F		N 1 E IV	S 2 E II	S 4 W IV		
	C						
	H		N ½ E II½	S 2½ E II½	S 3½ W IV½		½
441.	A	E III	N 1½ E I	S 1½ E III	S 7 W III		
	B	N 7 E III½	N 1½ E I	S 1 E II	S 6 W III½		
	C	N 5½ E IV		S 1½ E II	S 5 W III½		½
	D	N 5 E IV½		S 2 E 1½	S 4 W III		I
	E		N 1½ E II	S 1 E II	S 7 W V	½	½
	F						
	G						
	H		N 1 E III	S 1½ E II	S 5½ W IV½		½
442.	A	S 4 E V		S 1½ E II	S 7 W III		
	B	S 4 E IV½		S 1 E III½	S 7 W II		
	C		N 4 E ½	S 1½ E V	S 6½ W III½		I
	D	S 5½ E III		S 2 E IV	S 6½ W III		
	E	S 5½ E II½	N 2½ E I	S 1 E III	S 6½ W III	½	
	F	S 7 E III	N 2½ E I	S 1 E III	S 7 W III		
	G		N 2½ E II	S 1 E IV	S 7½ W IV		
	H		N 2 E II	S 1 E III	S 7 W IV		I

Square	Wind rose	g.	y.	b.	r.	Calms.	Unclassed.
476.	A		N 1 E III	S 1 E I	S 4½ W V		
	B		N III½	S 1½ E I½	S 4 W IV½		½
	C			S 1 E	S 4½ W		
	D		N ½ W IV	S 1½ E I	S 4½ W IV½		½
	E						
	F						
477.	A		N 1½ E III	S ½ E II	S 7 W V		
	B		N III	S 1 E II	S 5½ W V		
	C		N 1½ E III	S 1 E 1½	S 7 W VI		½
	D		N III½	S 1 E ½	S 5½ W VI		
	E		N 1 E III½	S ½	S 7 W VI		
	F		N IV½		S 5½ W V½		
	G						
	H						
478.	A		N 1½ E III	S 1 E II½	S 7 W IV½		
	B		N 1½ E III	S ½ E II	S 7½ W V		
	C		N 1½ E IV	S ½ E 1½	W IV½		
	D		N 1½ E III½	S 1½	S 7½ W IV½		
	E						
	F						

DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

DIAGRAM TO BE USED WITH THE TABLE OF GENERALIZED RESULTS.

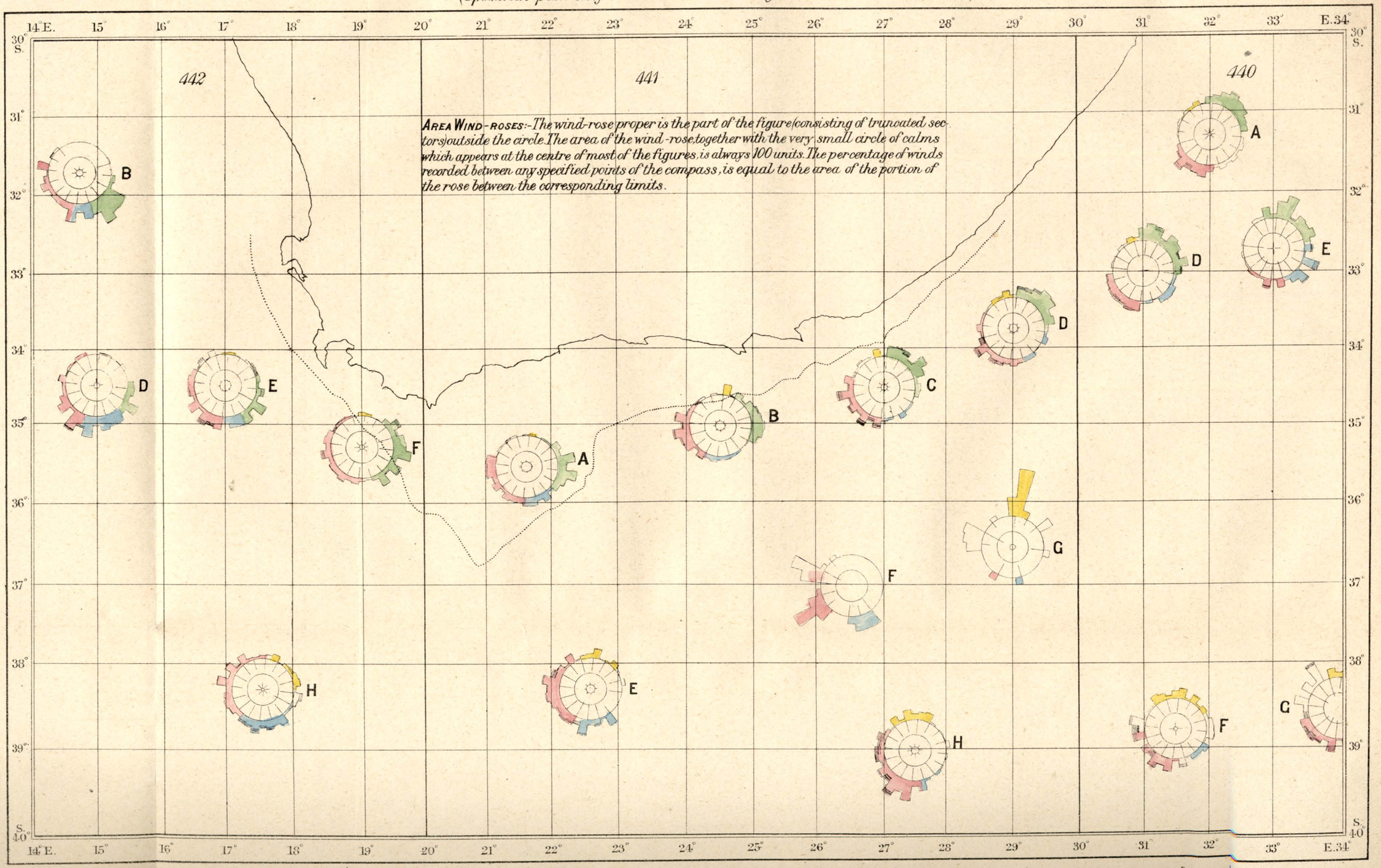
Cape Squares. April.



DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

APRIL — WINDS.

(Specimen-part only of the chart as shewn by the dotted line in Table IV.)


14° E. 15° 16° 17° 18° 19° 20° 21° 22° 23° 24° 25° 26° 27° 28° 29° 30° 31° 32° 33° E. 34°
30° S.
31°
32°
33°
34°
35°
36°
37°
38°
39°
S. 40°
442
441
440
AREA WIND-ROSES:-The wind-rose proper is the part of the figure consisting of truncated sectors outside the circle. The area of the wind-rose together with the very small circle of calms which appears at the centre of most of the figures, is always 100 units. The percentage of winds recorded between any specified points of the compass, is equal to the area of the portion of the rose between the corresponding limits.
A
B
C
D
E
F
G
H

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN.

116, *Victoria Street, January* 10, 1880.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | PROFESSOR STOKES.
MR. GALTON. | GENERAL STRACHEY.
THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last two meetings (December 13 and 20, 1879) were read and confirmed.

Reported—That the estimates for the year 1880–81 had been forwarded to the Treasury on the 23rd ultimo, and that Sir H. Ibbetson had conveyed (Letter 3170) their Lordships' provisional approval thereof.

Read—A letter from Mr. Stone (No. 3120), accepting the loan of the self-recording apparatus on the terms stated (Minutes, December 13), "but with an understanding "that the loan will probably be renewed at the end of the year if the work is "satisfactory."

Submitted—The following report:—

QUARTERLY REPORT.

SIR, Meteorological Office, December 31, 1879.

I HAVE the honour to report, for the information of the Council, on the work which has been done for the quarter ending 31st December 1879.

1. 108 ten-degree squares, containing 9,598 observations, have been discussed in sub-squares of two degrees, with the exception of Squares 486 and 487, off Cape Horn, which have been discussed in sub-squares of one degree.

2. I have constructed a Mercator's Chart of the Pacific, as nearly as possible of the same size as the ordinary Admiralty Chart, on which is plotted the arithmetical mean, to the nearest degree, of all the observations contained in each sub-square. The small red figures denote the range of temperature when it exceeds one degree.

3. The mean is plotted in the centre of a sub-square when the observations are uniformly distributed over the whole area. It has been necessary to record two, and in some few instances three, means in a sub-square. This has happened when the observations have been in groups of two or three, but in all cases the mean is plotted in the centre of the group of observations to which it belongs.

4. Single observations have their proper assigned positions according to latitude and longitude.

5. For the month of May extracts have been made from all logs and remark books of the sea surface temperatures and currents on 10 sheets (large) of the Pacific Ocean. This work was handed to me on joining the Office.

6. For the month of August extracts, the same as for May, are in progress. About a quarter of these have been done.

I have, &c.
C. W. BAILLIE,
Navigating Lieutenant, R.N.

Capt. H. Toynbee, F.R.A.S., &c.,
Marine Suprintendent.

Resolved—That Captain Toynbee be requested to instruct Mr. Baillie to proceed with the months of May, August, and November, on the same plan which he has hitherto followed for February.

The Form for the simultaneous observations at 0h. 43m. to be taken on board H.M. ships (Minutes, November 29) was re-considered and revised, and the Secretary was instructed to re-submit it.

Read—Letter (No. 60) from the Post Office, relating to the charges to be made in future for foreign telegrams (Minutes, p. 77), and agreeing to the proposals of the Council in their letter (No. 2932, 1879). The Secretary was instructed to acknowledge its receipt with thanks, and to request M. Mascart to resume the transmission, *via* Paris, of the reports from the Helder, which had been in force prior to 1871.

SUBMITTED—The following STATEMENT respecting the RECORDS for October 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH:—														
Action	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Indifferent.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	†11 hrs.	†13 hrs.	0	0	0	0	1 hr.	1 hr.
„ „ other causes	*1 hr.	*1 hr.	0	0	0	0	2 hrs.	1 hr.	0	0	0	0	‡24 hrs.	‡24 hrs.
Orientation verified	1st	—	10th	—	15th	—	7th	—	4th	—	20th	—	13th	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0	0	0	0	0	0	0	1
„ „ irregular differences	0	0	0	0	0	2	0	1	0	4	0	0	0	5
Result of 40 *Remeasurements*:—														
Greatest difference	0·0	2·0	0·0	1·0	0·0	2·0	0·0	1·0	1·0	0·0	0·0	1·0	0·0	3·0
Mean difference irrespective of sign	0·0	0·6	0·0	0·3	0·0	0·5	0·0	0·5	0·1	0·3	0·0	0·4	0·0	0·5
Residual difference (—Meteorological Office)	0·0	0·0	0·0	−0·1	0·0	+0·1	0·0	−0·1	+0·1	+0·1	0·0	+0·1	0·0	−0·1
RAIN GAUGE:—														
Action	Good.		Good.		Indifferent.		Indifferent.		Good.		Good.		Good.	
Records deficient, due to stoppage of clock	0		0		0		0		0		6 hrs.		0	
„ „ other causes	0		0		0		0		0		0		0	
Errors in tabulation	0		0		0		2		0		0		0	

BAROGRAPH :—

Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Do.	Do.	Do.	Indifferent.
Records deficient, due to stoppage of clock	0	0	0	2 hrs.	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	*2 hrs.	0	0	§1 hr.	0	0	0
No. of errors discovered—							
In entry of standard	1	2	0	2	5	0	1
„ calculating residual correction	0	1	1	0	0	0	0
„ applying residual correction	0	5	0	3	0	0	3
„ subtraction in subsidiary tables	0	0	0	1	1	0	1
„ tabulation by subsidiaries	0	0	0	0	0	0	0
„ „ irregular differences	2	0	4	1	0	1	0
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·008	0·006	0·005	0·009	0·006	0·007
Mean difference irrespective of sign	0·0016	0·0022	0·0023	0·0021	0·0025	0·0023	0·0028
Residual difference (— Meteorological Office)	−0·0010	−0·0015	−0·0005	+0·0014	−0·0014	+0·0017	−0·0004
Mean monthly difference between simultaneous barograph and barometer readings	0·0015	0·0029	0·0012	0·0015	0·0026	0·0014	0·0016

THERMOGRAPH :—

Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Do.		Do.		Do.		Do.		Do.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	1 hr.	1 hr.	0	0	0	0	0	0
„ „ failure of light	‖1 hr.	‖1 hr.	0	0	0	0	0	0	0	0	0	0	0	2 hrs.
„ „ imperfectly moistened bulbs	—	0	—	0	—	4 hrs.	—	0	—	1 hr.	—	0	—	0
„ „ partially frozen bulbs	—	2 hrs.	—	0	—	0	—	1 hr.	—	0	—	0	—	0
„ „ other causes	*1 hr.	*1 hr.	0	0	0	0	§5 hrs.	§3 hrs.	0	*1 hr.	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	3	0	0	1	0	2	3	0	0	0	1
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	0	0	0	0	0	1	1	2	2	0	0	1	1
„ „ detected under glass scale	2	2	16	0	1	1	17	17	11	4	1	1	6	12
Result of 40 *Remeasurements :—*														
Greatest difference	0·2	0·3	0·3	0·2	0·3	0·3	0·4	0·4	0·3	0·2	0·2	0·3	0·4	0·5
Mean difference irrespective of sign	0·11	0·12	0·15	0·12	0·11	0·09	0·15	0·15	0·09	0·09	0·08	0·12	0·14	0·16
Residual difference (— Meteorological Office)	−0·8	−0·01	−0·15	−0·03	+0·08	−0·08	+0·10	−0·09	−0·06	+0·03	+0·06	+0·07	+0·01	−0·08
Mean monthly difference between simultaneous thermograph and thermometer readings	0·14	0·08	0·11	0·13	0·07	0·08	0·22	0·26	0·17	0·20	0·10	0·15	0·22	0·17
No. of errors in maxima and minima	0	—	17	—	0	—	4	—	5	—	0	—	4	—

* Instrument under inspection. † Clock-line broken. ‡ Pencils left unclamped. § Cylinder not properly started. ‖ Gas-pipe under repair.

Read—A memorandum from Captain Toynbee reporting that since last meeting eleven logs had been received, eight of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. E. C. Bennett	Ship "Thessalus."	April 4—Dec. 28, 1879.	Calcutta and home -	1878, p. 122.
Capt. E. J. Blake -	Ship "Tilkhurst"	Oct. 19, 1878—Dec. 21, 1879.	Cardiff, Bombay, Calcutta, and home.	1875, p. 24.
Capt. H. Emmett -	Barque "Sophia Joakim."	May 31, 1878—April 19, 1879.	Dundee to Sandarne, Adelaide and Tamatava.	—
Capt. W. Randall -	Ship "Iron Cross."	Aug. 1, 1879—Jan. 2, 1880.	Liverpool, New Orleans, and home.	1879, p. 61.
Capt. W. Scott -	Brig "Alliance"	July 10—Dec. 22, 1879.	Glasgow to Surinam -	1879, p. 61.
Capt. A. Simpson -	Schooner "Traveller."	April 14—Nov. 15, 1879.	Granton to Ivigtut, Philadelphia, and home.	1878, p. 122.
Capt. W. H. Stuart -	Schooner "Richmond."	July 1—Nov. 1, 1879.	Cruising amongst the Bahamas.	1879, p. 78.
Capt. E. W. Turner	Barque "Mertola"	June 12—Dec. 28, 1879.	Liverpool to Pomaron and home, three voyages.	1879, p. 24.

Mr. Scott was instructed to present the charts (O. 27) to Captain Emmett, and to convey the best thanks of the Council to the other observers.

Submitted—The following reports:—

REPORT on the SCOTTISH METEOROLOGICAL STATIONS of the METEOROLOGICAL OFFICE, for 1879.

BAROMETERS.

THE barometers at the stations were compared with a small pocket aneroid, No. 11, and those of Ardrossan, Glasgow, and Leith also with a mercurial marine barometer, No. 456. This marine barometer was taken also to Glenalmond, but on this occasion it was not available as a standard for comparison, as air had unfortunately got into the tube in transit. In the other cases it is believed that the tube was entirely free from air.

The following table shows the corrected readings of Inspector's standard, No. 456, corrected for index error; the readings of aneroid No. 11; and the uncorrected readings of the reporting and check barometers of each of the stations:—

TELEGRAPH REPORTING STATIONS.	Inspector's Barometer, No. 456.	Aneroid, No. 11.	Reporting Barometers.	Check Barometers.	Att. Therm.
Aberdeen - - -	—	29·515	29·518	—	—
Do. - - -	—	29·450	—	29·450	—
Nairn - - - -	—	29·925	29·921	29·920	—
Wick - - - -	—	29·780	29·782	—	—
Do. - - - -	—	29·705	—	29·704	—
Sandwick - - -	—	30·015	30·058	—	—
Dunrossness - - -	—	29·795	29·808	29·796	—
Stornoway - - -	—	29·510	29·526	29·507	—
Laudale - - -	—	30·105	30·168	30·165	—
Ardrossan - - -	30·114	30·080	30·110	30·116	—
Glenalmond - - -	—	29·320	29·243	—	—
Leith - - - -	30·135	30·080	30·146	30·150	—
OBSERVATORIES.			Adie, London, No. 1149.		
Aberdeen - - -	—	29·530	29·533	—	62
			Adie, No. 1366.		
Glasgow - - -	29·935	29·930	29·907	29·924	56

The small aneroid No. 11 was carried on my person during the whole period of inspection. There are some peculiarities about this instrument it is desirable to advert to. Previous to, during, and after inspection particular attention was paid to its action. Readings were made true so far as possible to 0·005 inch.

From a day or two before setting out on the inspection on August 6th, to a day or two after my return to Edinburgh on September 19th, the readings of the aneroid No. 11 did not appear to

differ more than 0·010, plus or minus, from the standard mercurial, No. 456, between the heights of 29·200 and 29·950 inches; and it is to be noted that I had No. 456 with me for comparison from the time I reached Oban on August 22nd.

Hence it may be assumed from the above comparative readings that the barometers at Aberdeen, Nairn, Wick, Dunrossness, Stornoway, and Ardrossan remain in the good order which they were reported to be in last year.

At higher readings than 29·950 inch, the readings of aneroid No. 11 require a *plus* correction rapidly increasing with the height. Ten comparative readings of the mercurial barometer No. 456 were made with the aneroid No. 11 between 30·022 and 30·095 inches. The mean of these ten readings was 30·062 inches, and the mean error of the aneroid was —0·037 inch. From this result it is also highly probable that Sandwick barometer is in the same good order as last year.

In conveying the barometer to Glenalmond air unfortunately got into the tube and lodged in the air-trap. Since in all likelihood it would have taken from four to six hours to expel this air and make a satisfactory comparison thereafter, a comparison with aneroid No. 11 only was made. This comparison showed the reading of the aneroid 0·077 inch higher than that of Glenalmond barometer. On the Monday following I compared aneroid No. 11 with the barometer at the station of the Scottish Meteorological Society at Perth, which is a good instrument. The aneroid read 0·044 inch higher than the Perth barometer, which stood at 29·211 inches (att. ther. 50°·0).

The action of aneroid No. 11 was at this time, October 18th, very irregular, as will be seen from the following readings made the day before leaving Edinburgh:—

	Inches.		Error of Aneroid.
Barometer No. 456 -	29·472	-	+0·088
	29·504	-	+0·076
	29·622	-	+0·048
	29·685	-	+0·051

and on Monday evening on returning to Edinburgh—

	Inches.		Error of Aneroid.
Barometer No. 456 -	29·380	-	+0·010
	29·509	-	+0·011
	29·567	-	+0·003

Since the previous inspection in 1878, the barometer at Glenalmond has been removed to a new position, but from the extreme care and skill which characterises the observer, the Rev. Dr. Percy Robinson, it is very probable that the Glenalmond barometer also remains in good order.

I have gone somewhat into detail on this matter with the view of illustrating the extreme caution required in using the aneroid in inspection.

In my last Report I stated an intention to calculate, before setting out on this year's inspection, the monthly mean pressures at 8 a.m. of all stations for the two years ending June 1879, and it was further my intention to calculate, or otherwise procure for the same time, the barometric means for as many places over the British Isles as possible with the view of obtaining a comparative view of the barometers. But my slow recovery from the effects of the September accident rendered it impossible to overtake the great labour this involved. Since my return to Edinburgh this work has been to some extent overtaken.

The more specific reason for undertaking this work is the experience gained in inspecting, which shows that it is in this way that an idea can best be formed of what errors of the instrument, what errors due to imperfect habits of observing, or what errors due to incorrectly stated heights may possibly exist, and should be inquired into at the time of inspection.

I forward a map of the British Isles, on which are set down in their places the mean atmospheric pressure for the year 1878 for such stations as I have calculated, or otherwise obtained the means of, the black figures being the means for the two hours 9 a.m. and 9 p.m., and the red figures the means for 8 a.m., these last being the means of the telegraph reporting stations. There are also added the means for the seven observatories of the Meteorological Council, but as regards each of these the December means were interpolated by differentiation from the means of stations in their neighbourhood.

A comparison of the means for 8 a.m. with the means for 9 a.m. and 9 p.m. shows that for the annual means the correction for the 8 a.m. means is

Inch.	
0·006	for Valentia.
0·003	„ Armagh.
0·000	„ Glasgow.
0·004	„ Aberdeen
0·007	„ Falmouth.
0·002	„ Stonyhurst.
0·001	„ Kew.

These refer to the 1878 observations only. Other years give the corrections of 0·002 inch for Culloden, 0·004 inch for Makerston, 0·002 inch for Liverpool, and 0·003 inch for Greenwich.

It follows that, and particularly as regards Scotland, these two sets of means closely correspond, and that roughly speaking they may for the present purpose be accepted as comparable.

Stornoway Barometer.—A comparison of this barometer with those around it on the map

indicates a mean about 0·030 inch too low. The following are the means for the months compared with those for Stornoway Castle:

		Stornoway Castle.	Teleg. Rep. St.
1878.	January	29·925	29·916
	February	30·007	30·003
	March	29·922	29·932
	April	29·818	29·791
	May	29·700	29·641

from which date down to the present time, this difference continues to obtain between these stations' barometric means.

It was in the spring of 1878 that the instruments were transferred from the Castle to Nicolson's Institution. Next inspection will best settle how this difference has arisen. I may in the meantime express an opinion that there is probably an error in the height of the barometer as given and probably an error in the mode of setting the vernier. At the time of inspection, Mr. Sutherland set it too low, and was on the point of reading it in that state when of his own accord he set it correctly, as it turned out. The first setting was perhaps 0·015 inch too low. The height was stated to have been levelled from a bench mark by Mr. Smith and a local surveyor, but the calculations have been destroyed. I have written Mr. Sutherland to re-level it from a bench mark I sent him, but I have not yet received an answer.

Leith Barometer.—This barometer also appears to be about 0·030 inch too low. Since last year's inspection in the end of 1878 the correction in the height then supplied has, judging from the six months' means ending November last, been reduced to 0·020 inch. This difference is probably due to an error in setting the vernier referred to in my last Report, and which may not yet be completely corrected on the part of Mr. Turnbull the observer and his assistant. I shall take an early opportunity of again inspecting Leith with regard to this point.

Ardrossan Barometer.—As compared with stations in the vicinity this barometer would appear to be close on 0·020 inch too low, and a comparison of the means for the six months ending November last shows the same difference. In my last Report this was shown to be about the error arising from the observer's mode of setting the vernier which he thought to be the correct one. It is probable that this method of setting the vernier is still adhered to, or at least very often practised, though at the time of this year's inspection the instrument was correctly set and read by the assistant temporarily in charge. I may here parenthetically draw attention to the low barometric mean for Greencastle on the map.

Barometers at the Glasgow and Aberdeen Observatories.—An inspection of the map will show that Glasgow mean is about 0·010 inch *below*, and Aberdeen mean 0·010 inch *above* the mean in those parts of Scotland. This is a point to which I shall give special attention next inspection.

Marine Barometers.

In last Report I drew attention to what was conceived to be a defect in the working of these barometers due to the extreme sluggishness of their movement, and a reference was added, as kindly suggested by Mr. Scott, to the *conditions to be fulfilled by marine barometers of the pattern adopted by the Meteorological Office.* Thereafter some observations on the action of the marine barometer by Mr. Scott and Professor Stokes were printed. These observations and the discussion thereon by Professor Stokes clearly showed that the marine barometers which are supplied to the telegraph reporting stations fulfil the conditions referred to.

This, however, was not the point which I had intended to lay before the Meteorological Council, that point being to suggest whether these conditions, hitherto accepted as sufficient, should not be reconsidered with a view to a revision.

The point does not refer to the rate at which the mercury falls in the tube of the marine barometer, for the last inch, or inch and a half, before it falls to a point about a tenth of an inch above the reading of the standard with which it is compared, *but has reference exclusively to the behaviour of the instrument at readings differing only* 0·030 *inch* AND UNDER *from the standard.*

The following three sets of readings, giving a comparison of the Scottish Meteorological Society's Standard with Inspector's Standard, No. 456, the S.M.S. Standard readings being reduced by 0·010 inch, which is its constant error as compared with the mean readings of the Kew Standard:—

(1.) With rising barometer:—

1879.		Error of No. 456.
Jan. 18, noon	29·876	−0·016
„ 1 p.m.	·900	−0·014
„ 2 „	·923	−0·016
„ 3 „	·962	−0·012
„ 9 „	30·140	−0·018

(2.) With falling barometer:—

1879.		Error of No. 456.
Sept. 27, 9 a.m.	30·150	+0·005.
„ 3 p.m.	·003	+0·004.
„ 9 „	29·875	+0·012.

(3.) With falling, then rising, barometer:—

1879.		Error of No. 456.
December 14, 9 a.m.	30·127	+0·009
„ 1 p.m.	·097	+0·004
„ 3 „	·103	−0·002
„ 6 „	·150	−0·014

It is this view of the matter that led me in my last report to remark, "It follows that in "those cases when pressure is falling in the west of Ireland, or rising or stationary in the east of "Great Britain, or *vice versâ*, the barometers in use at the telegraphic reporting stations are not "suited to show the real difference between the two places, and that the error may be so consider- "able as to materially affect the forecasts framed from the readings."

The error of 456 fluctuates between — 0·018 inch with a rising pressure and +0·012 inches with a falling pressure, but the errors for different rates of fluctuation of pressure I have not yet determined.

With extraordinarily rapid fluctuations of the barometer, larger errors than the above occur. Thus, on the occasion of the singular depression of the barometer on December 28th, 1879, the following readings were made and errors of Inspector's Standard No. 456 noted:—

1879.		Inch.	Error of No. 456.
December 28,	1.30 p.m.	29·502	+0·012
„	3 „	·350	+0·030
„	3.30 „	·266	+0·024
„	3.45 „	·234	+0·032
„	5 „	·118	+0·029
„	6 „	·091	+0 015
„	7 „	·092	+0·003
„	8 „	·127	−0·004
„	9 „	·178	−0·022
„	10.30 „	·300	−0·020
„	11 „	·328	−0·015

The sum of the two extreme errors in the above readings is 0·054 inch, the amount of range of error of No. 456 in recording the stages of this remarkable barometric fluctuation.

Thermometers.

The following table gives the results of the comparisons with Inspector's Standard No. 1553 of the thermometers at the various stations, the readings of this standard thermometer being corrected for its instrumental errors:—

Telegraph Reporting Stations.	Insp. Stand. No. 1553 Corrected.	Errors of: Dry Bulb.	Wet Bulb.	Spare Ther.	Max. Ther.	Min. Ther.	Time in Water in Minutes.	Change of Temperature of Water.	Remarks.
Aberdeen	61°·0	+0°·4	+0°·7	+0°·5	+0°·7	+0°·9	180	−0°·5	
Nairn	52·9	+0·3	+0·7	+0·5	+0·3	+1·0	120	+0·3	
Wick	56·2	+0·4	+0·4	—	+0·1	−0·1	75	+0·4	
Sandwick	57·6	+0·5	0·0	—	+0·8	—	120	+0·2	Min. ther. rusted to supports.
Dunrossness	60·3	*+0·1* / +0·4	*+0·1* / +0·3	+0·3	+0·3	−0·4	135	+0·3	Italic figures are new thermometers.
Stornoway	61·3	+0·5	+0·4	+0·5	+0·1	−0·3	90	+0·4	
Laudale	58·0	+0·4	+0·3	+0·4	+0·7	−0·3	120	−0·4	
Glenalmond	47·3	+0·1	+0·1	—	+0·1	−0·2	80	−0·2	
Ardrossan	55·7	+0·1	+0·1	+0·2	−0·1	−0·1	90	uniform	
Leith	54·0	+0·3	+0·5	—	+1·3	−0·3	70	do.	Has deducted 1°·0 from each reading of max. ther. since Mr. Scott's last visit.

Observatories.		Max. No. 48.	Min. No. 89.	For Eye Obsns. Dry. No. 458.	Wet. no No.			
Aberdeen	57°·9	+0·4	+0·1	0·0	+0·6	—	—	—
		Eye Observations. Dry.	Wet.	Max. No. 10.	Min. No. 5433.			
Glasgow	55·0	+0·2	−0·1	+0·3	+0·1	—	100	—

The above corrected readings of No. 1553 were obtained by subtracting 0°·8 from each reading in accordance with corrections for this thermometer received from Kew shortly before starting on inspection. Last year the correction for this thermometer, which was used on that occasion also, was 0°·9.

The minimum thermometer at each station was found to be in good order.

Box for Thermometers and their Positions.

The pattern of box for the thermometers is Stevenson's at all the telegraphic reporting stations except at Stornoway where the old pattern of wall-screens is still used.

Aberdeen.—Since the previous inspection the box for the thermometers has been removed to the position near the centre of the grass plot as recommended in last Report, which for ordinary

climatological purposes may be characterized as good. It was recommended that stronger posts be got for the box, and that these and the box be painted white. Another house has been built to the west of Mr. McCormack's, but as all the houses built, and to be built there, are small detached villas with garden plots in front and behind, the situation for the instruments will continue to remain comparatively an open one.

Nairn.—On his return from Strathpeffer, whither Mr. Penny had been some time for the sake of his health in September 1878, the instruments were removed from Mr. Symon's to Delnies without sustaining any damage. The thermometer box was placed in the new position as directed in last Report, being the best available and a good one. Some little progress has now been made in cutting the trees referred to in last Report, and as this proceeds the situation as a meteorological station will be greatly improved. It may be added that Mr. Penny's method of reading the instruments is highly satisfactory, being such for example as to leave no doubt in my mind that his barometric readings were made exactly from the tangent to the curved surface of the mercury,—an opinion quite borne out by the accompanying map.

Wick.—As directed at last inspection the thermometer box had been strengthened with four supports, and painted white, and it is now quite firmly fixed. At midsummer the sun shines on the box from 6 a.m. till near sunset, at the time of inspecting (August 13th) from 7.30 a.m., and at midwinter from about 11 a.m. Mr. Sinclair's house is one of a single row of small houses running south and north, the locality being quite open to east and west.

The observer still continued to add a degree to each of the readings of his maximum thermometer.

The rain-gauge is now well fixed. It will be seen from the enclosed squeeze of the rim of the rain-gauge that it was, as on the previous inspection, somewhat off the circular. It was again made circular. It seems a well-made gauge, but does not appear to stand weathering.

The locality immediately to the north, outside the town, was examined, and it seems well adapted for an anemometer, if it were judged desirable to place one so near the sea, provided means could be taken to protect it from injury.

Sandwick.—The thermometers and other instruments remain generally as described in last Report. The rain-gauge has been placed on a new wooden stand, and is now well fixed, its rim being 2 feet 4 inches above the ground. Six equi-distant diameters were 11·50, 11·35, 11·25, 10·00, 11·05, and 11·25 inches, being substantially the same as last year. This rain-gauge was originally placed in centre of the lawn in front of the manse, but was afterwards removed to its present position. After the change was made another gauge was kept for some time in the lawn, and the two gave results closely accordant.

The cleaning of the anemometer effected some time ago, being the first cleaning for 12 years, appears to have been satisfactory and thorough ; the instrument during the cleaning being out of gear only a few hours. The paper is changed every day at 10·15 a.m. with great punctuality by Dr. Clouston, or if he is from home, by one of the family or domestics, who are all more or less trained observers. The door of the erection for the anemometer opens to east, and the cups stand about 16 feet above the ground. The instrument was in a satisfactory condition, and its position as formerly remarked is admirable.

Dunrossness.—The thermometer box and rain-gauge have been removed to new positions of a first-class character for the observations, which positions will be shown on the small plan of the stations. The thermometer box is placed on four strong posts, the whole being painted white and immovably fixed in the ground. Everything at this station is in excellent order, and Mr. Brand and his assistants observe and go through the computations with accuracy and expedition.

I took a set of dry and wet bulb thermometers, sent from the Meteorological Office for the purpose, to this station and brought back the old ones.

Having learned that the district around Dunrossness Manse had been surveyed by the Ordnance Survey, I obtained from the director of the survey the two heights nearest the manse and forwarded them to Mr. Brand, with a request that he would level his barometer from either of these heights. Both these heights are unfortunately at some distance from Mr. Brand's.

Stornoway.—All the instruments remain in the same positions as on the previous visit, the minimum thermometer and the other instruments being found in good order.

As reported last year, the grass field in which the school premises are situated affords first-class positions for a Stevenson's thermometer box. The best of these I indicated on the small plan of the station and I was informed by Mr. Sutherland that there would be no difficulty in obtaining permission to place the thermometers in that position: but in that case it will be necessary for the safety of the instruments to enclose them within a light wire fence. The present boxes are wall-screens held to the wall by holdfasts, the bulbs being only 3 inches from the wall and the situation close and confined in the extreme, the whole arrangements for observing the temperature being bad.

Laudale.—As the four posts supporting the thermometer box were so short as to admit of a height above the grass for the bulbs of the thermometers of only 2 feet 9 inches, I gave directions for new posts which will admit of the bulbs being 4 feet above the grass. With this single exception, the position of the instruments and the whole arrangements for observing at this station are admirable.

Ardrossan.—Both barometers were found to be in good order, including the one which Mr. McNeil had removed from his house to the telegraph office before leaving for Troon. Since a door was to be made at that part of the wall of the office where the reporting barometer has hitherto hung, it was directed to be hung on the wall opposite and beside the spare barometer, this being the only good position available.

The unsuitability of the situation for the thermometers and rain gauge is even more evident than at the time of last Report, owing to the changes being pushed forward by the railway. I looked

at two positions which were stated to be probably available, one of these is immediately behind the telegraph office, and the postmaster would be willing to give the use of it: but the situation, while very convenient to the clerks, is very confined. The other situation is in the garden attached to the Eglinton Arms Hotel, and affords a fairly good position for the instruments. In addition to the smoke and dust from the railway the present arrangement is faulty from the shortness of the posts which raise the thermometers only 2 feet 9 inches above the ground, from the quantity of black earth around the thermometer box, from the house near it, and from the vegetables grown in the plot, the rain-gauge this year being in a plot of leeks, which at the time of inspection had begun to overtop the rim of the gauge.

Leith.—The instruments at this station remain in the same positions as at the date of last inspection. As requested by Mr. Scott some time ago, I looked out for a new position for the thermometers and rain-gauge, with the result that the only available position was a small garden plot in front of the office of the Leith School Board, Links Place, which immediately faces the links on the north side. A careful examination of this position, however, showed that little advantage would accrue from the change, owing to its comparatively close proximity to the house, the broad public road just outside the railing, and the predominance of black earth of the flower plots and the rather broad walks through these plots. This was felt to be more particularly the case on hearing through Mr. Bolam that the burgh surveyor was likely to give his permission to cut down the trees which now so much interfere with the temperature and rain observations. I have twice missed seeing Mr. Beatson, the surveyor, when in Leith, but shall see him soon on this matter and report.

I gave directions to paint the thermometer box white, it having got much begrimed with exposure to weather and smoke.

As suggested, I inquired very particularly into the methods adopted by Mr. Turnbull and the assistant observer in noting the wind, going a good deal into details, which appeared to be fairly understood.

I have also inspected Mr. Bolam's instruments and their positions. Most of the instruments are in the Navigation School-room, and form in Mr. Bolam's hands a valuable part of the scientific equipment of the school. The pupils therewith have the benefit of a good initiatory drill in the work of observing. A comparison of the sea-level pressures at the Post Office with those at the Navigation School a few minutes thereafter, showed Mr. Bolam's two barometers to be in good order. All the other instruments were in a sound condition except thermometer No. 1473, whose scale was broken, but tube whole, and two hydrometers which were broken and their numbers lost. I also went to Mr. Bolam's Stevenson's box in ex-Provost Lindsay's grounds, where the hygrometer is regularly observed, and is well placed, mounted, and in good order. We climbed to the top of the tower in Mr. Lindsay's garden with the view of seeing how far it might be suitable for an anemometer. It does not seem to rise sufficiently clear of trees and other objects in the neighbourhood as to warrant recommendation as a suitable station for wind observations.

Glenalmond.—The changes effected at this station since last inspection are (1) the removal of the barometer for greater convenience in making the observations, on the completion of the repairs on the college occasioned by the fire there some time ago; (2) the procuring of a new Stevenson's box; and (3) the placing of this box on the south side of the gravel walk instead of the north side as before, to secure the opening of the box on the north side.

The old thermometer box has been placed in another position a little way off, and been put entirely into the hands of the pupils who regularly make observations, plotting them in colours as made, which are compared weekly with those made by Dr. Robinson himself and assistants. The training to systematic and accurate observation is, it need scarcely be added, very satisfactory and complete. The station besides may be regarded as a model one, whether respect be paid to the desirability of the situation and positions secured for the instruments, their excellent quality, or the admirable order in which everything is kept.

It is desirable that the height of the cistern of the barometer be ascertained by levelling from the nearest bench-mark, which is about a mile distant, as the present height was deduced entirely from observations made with the aneroid.

Rain-Gauges.

The heights of the rain-gauges above the ground remain as at last Report.

The five-tenths inch glass measures at the stations contain the following number of grains as measured by the standard carried with me, the gauges being in all cases 8 inches in diameter:—

Aberdeen	6,270 grains.	
Nairn	6,250 „	
Wick	6,290 „	
Dunrossness	6.285 „	
Stornoway	6,300 „	new measure from August 16th.
Laudale	6,300 „	
Glenalmond	6,300 „	
Ardrossan	6,330 „	
Leith	6,350 „	Broken and pieced together with cement. A new one is required.

In all cases the tenths were also measured, and in every instance the measure was accurately divided into five equal parts.

The Observatories of Aberdeen and Glasgow.

At each of these observatories the positions of the thermometers with their screens, the excellent order in which the instruments were kept, and the intelligence and precision with which the photographic curves were produced and thereafter converted into figures, were the same as at last Report, and need not therefore be further adverted to.

I had examined the contours of the surface for some distance round Aberdeen as laid down on the Ordnance Survey Maps, and from a careful examination of the whole district as seen from the tower of King's College, I came to the opinion that the present position of the anemometer is as good as could be had in that part of Scotland, if those positions be regarded as suitable which lie within the influence of the sea-breeze. The disturbing influence of the valleys of the Dee and the Don might perhaps be approximately estimated by a discussion of the whole of the westerly winds registered by the anemometer during two or three of the years it has been in action.

At Glasgow the receiver of the registering rain-gauge was off the circular, the longer diameter being 11·4 inches, and the shorter 11·3 inches. This receiver is glazed inside with a porcelain coating. Of course nothing was done to make it circular. The way in which some rain-gauges, apparently well and strongly made, do not stand weathering, resulting in rims more or less elliptical, is certainly a curious point and deserves examination.

At the time of inspection at Glasgow the direction of the wind as indicated by the anemometer differed considerably from that indicated by Osler's anemometer, which latter closely corresponded with the general drift of the smoke from the houses in the immediate neighbourhood as seen from the top of the observatory; and Mr. McLean, the assistant, stated that important differences in the direction of the wind as registered by these two anemometers, were of not unfrequent occurrence. Whether the difference is due to the instruments or to the buildings of the observatory, is a matter for inquiry; and, if the difference still continues, I should be glad to meet Mr. Whipple at the observatory during his next inspection, as possibly we might together be able to throw some light on the matter.

On the drum on which the velocity is registered there occurs a hitch in each of the curves examined at a point indicating a little more than 20 miles from the top of the card, due to some irregular action of the instrument.

The barometer for the eye-observations had been repaired some time before, and the optician had unthinkingly filed away a portion of the lower part of the vernier behind the column. To secure the necessary horizontality of the eye in setting the vernier, a small piece of cardboard had been inserted to replace the piece of metal filed away. So far as could be judged from the only examination I could make of it, which was necessarily rough, the arrangement seemed to have been made with approximate correctness. Considering also that much of the silvering is off the scale part of the instrument, thus rendering the readings a little troublesome at least to a stranger, it might be worth considering whether a new standard barometer for the eye-observations might not be sent to this observatory. There is also in the observatory an Adie's barometer No. 1366, which is often read.

I forward a map of the mean pressure at Scottish stations for November 1879, which may be of use for a comparison of the Glasgow and other barometers to a recent date.

Alexander Buchan.

Report of the Stations of the Meteorological Council in England, inspected in the year 1879.

Dear Sir, January 5th, 1880.

I have the honour to submit the following Report of the Meteorological Stations, inspected by me in the course of the year 1879.

I much regret that I should be under the necessity of commencing my first Report with an apology for not having, during the year to which it refers—the first year of my inspectorship—inspected all the stations of the Meteorological Council in England, and also for the delay which has occurred in the preparation of this Report. I was under the necessity in the past year of deferring my inspection tours until the autumn and winter, when the work of inspection was unfortunately much interrupted by a long attack of illness. For the future I intend to accomplish my journeys of inspection in the spring and summer months, so as to be able to submit my report at the beginning of the last quarter of every year.

Stations inspected.

All the Telegraphic Reporting Stations in England have been inspected by me during the year, with the exception of Oxford and Nottingham.

Of the Stations of the Second Order the following have been inspected:—

Chatham.	Geldeston (Suffolk).	Saffron Walden.
Chigwell Row (Essex).	Harpenden (Hertfordshire).	Seaham.
Durham,	Hull.	Southampton.
Douglas.	Leicester.	St. Aubin's, Jersey.
Folkestone.	Netley.	

Barometers.

At all the Telegraphic Reporting Stations, with five exceptions, the reporting barometers were found to read to within ·005 in. of the Inspector's standard. The exceptions were: Cambridge, where, at the observed pressures, the readings of the reporting barometer were ·012 too high; Scilly,

·009 too high; Shields, ·007 too high; Bidston, ·007 too low; and Hurst Castle, ·020 too low. In the last-mentioned instance, the most serious, I recommended the substitution of another instrument.

In reference to the condition of the instruments, to the accuracy of the observers' readings, &c. the report which I have to make is, as regards the telegraphic reporting stations, very satisfactory. The instruments were kept clean, and the observers, after setting the verniers, read in every instance to within ·004 of the Inspector's readings.

At the Stations of the Second Order the observers' readings were taken as accurately as at the Telegraphic Reporting Stations. At one station only (Netley, Southampton) was the barometer found to be ill-attended to. At this station the instrument was very dusty, and the air-hole plugged with dirt. At Seaham the observer read inaccurately.

The position of the barometers I found to be, in all but two instances, as good as can be obtained at the stations, though not in all cases unexceptionable. At Spurn Head I removed the barometers from a dwelling house to a position within the lighthouse, and at Shields I ordered an alteration which I considered desirable to be made in the position of the instruments.

Height above Mean Sea Level.

At those Telegraphic Reporting Stations at which I was able to calculate the altitude of the barometer cisterns above the sea level, I concluded that the altitude as previously determined was correct to within 31 inches, with one exception, viz., Prawle Point. My time at this station was insufficient for levelling, but according to my aneroid readings an error of +41 ft. 6 in. existed in the previously determined altitude of this station. I do not trust the aneroid, and in my next year's visit to this station I shall endeavour to determine the altitude with greater precision.

Thermometers.

At all the Telegraphic Reporting Stations the thermometers were found to be in pretty good order, except at Shields. I found it necessary to make a few slight alterations in the mounting of the wet bulbs, but in only one instance (Shields, where the atmosphere is very smoky), had I to complain of the condition in which the instrument is kept.

A similar statement may be made as regards the instruments, including solar radiation thermometers, thermometers for earth temperatures, and thermometers exposed on grass, at the Stations of the Second Order, except that at Seaham the maximum thermometer had been broken, and in the minimum thermometer the thread of spirit was not continuous, and that at Leicester the muslin on the wet bulb was coated with lime.

Comparisons of the thermometers exposed in air, and also immersed in water, revealed no more than the slight discrepancies usually found to exist between the readings of those instruments, discrepancies which were in no case so important as to render necessary the rejection of any of the reporting thermometers.

Thermometer Screens.

At all the inspected Telegraphic Reporting Stations, with the exception of Dover, a Stevenson's screen is in use. This screen is also employed at all the inspected Stations of the Second Order, except Durham, Harpenden, and Hull. Dover and Hull are the only stations, inspected in 1879, in which a wall screen is now in use. The position of the screens is not by any means in every case unexceptionable, but is nevertheless as good as can well be obtained under the exigencies of the several localities. In no instance, therefore, did I change the position. In several cases it was necessary to strengthen the stand of the screen with supports, as it had become loose and liable to be shaken by the wind. The Stevenson's screen (where in use) is over grass, except at Hurst Castle, Prawle Point, Spurn Head, and at Chigwell Row. Grass refuses to grow at Hurst and at Spurn Head, and (as stated by the observer) at Prawle Point.

Rain-Gauges.

Of the instruments employed at the stations, the rain-gauge is the least carefully attended to. At three only of the Stations of the Second Order did I find the rim of the rain-gauge much inclined, but at one half of the Telegraphic Reporting Stations, the inclination was serious, one side of the rim of the 8-inch gauge being $\frac{3}{8}$-inch lower than the opposite side. As rain-gauges are liable, from several causes, to be slightly moved between the dates of the Inspector's visits, it might perhaps be advisable to supply the observers with spirit-levels, and to request them after application of these at stated periods, to rectify any inclination which may be found to exist. The need of this is, I think, apparent from such facts as the following: the observer at Seaham apparently failed to discern, without the use of the level, that one side of the rim of his 8-inch gauge was *one inch* lower than the opposite side.

At one of the Telegraphic Reporting Stations (Shields) a leakage was discovered in the funnel, and at one of the Stations of the Second Order (Netley) the measuring glass was found to be broken.

As regards position, the rain-gauges are mostly placed in the best situations available. At one only of the Telegraphic Reporting Stations (Prawle Point), and at one of the Second Order Stations (Geldeston) did I think it necessary to have an alteration made in the situation of the gauge.

At one station only is the recording gauge situated on the roof of a building, viz., at Dover, where no other position seems to be at present available.

In respect to fairness of exposure of the rain-gauges, and therefore of the degree in which their

records approximate to an exact expression of the rainfall of the place, I arrange the Telegraphic Reporting Stations inspected by me in 1879 in the following order:—

		Nature of probable Error.
Spurn Head, Hurst Castle	Good	+ (Occasionally catch spray.)
Scilly, Shields, Liverpool, Jersey	Good	− (Slight and uncertain.)
London, Cambridge, York, Prawle Point	Pretty good	−
Yarmouth, Dover	Bad	− (Dover probably −16 per cent.)

Self-recording Rain-Gauges.

Seem to work well where in use. At Falmouth Observatory the Beckley's self-recording rain-gauge does not work quite satisfactorily. Owing to a mechanical defect, the pencil refuses to traverse the whole scale before the vessel empties itself by the siphon,—a fault which must, I think, lead to difficulties, and probably to occasional errors, in computing. The slips are also $\frac{1}{16}$-in. too wide for the cylinder, requiring to be cut before insertion.

Wind Observations.

While observations of the wind are scarcely inferior in importance to those of barometric pressure, the degree of suitability of each station for this class of observations, and the amount of retardation and deflection of the winds from the several points of the compass at each station, are extremely difficult of determination. Of the time at my disposal at the stations I employed a large portion in this inquiry; but the results of inquiries conducted in this manner are necessarily meagre, and at most stations it is only possible to form a rough conjecture of the degree in which the winds from different quarters are felt at the place. I am engaged in preparing graphical constructions representing the mean estimated wind force at the stations under my inspection for each direction of wind and for different amounts of barometrical gradient. These figures, which, with the permission of the Council, I hope to submit to the consideration of the Council with my next Report, exhibit the actual degrees of exposure of the stations more correctly than can be done by local observation alone, and appear to me to be further available as indices of any changes which may from time to time occur in the observer's estimation of wind forces, and for other purposes. At present it will perhaps be sufficient if I remark that of the English coast stations of the Meteorological Council the best exposed are Spurn Head and Scilly. Hurst Castle perhaps follows next. Jersey is also very good. Prawle Point is well exposed on the south-east, but the land on the north is rather broken and hilly. Shields is pretty well exposed on the east. Gales from the west are also often felt with exceptional force at this station, the valley of the Tyne perhaps concentrating, as in a funnel, winds blowing from westerly points across the north of England. It is worthy of remark that a strong westerly breeze is not unfrequently felt in the early hours of the morning at Shields, which is said to be scarcely perceptible two miles out at sea. Dover is perhaps the least satisfactory station on the coast for wind reports, winds from between West and N.N.E. being to a great extent cut off by the high land in those directions.

As regards the estimation of the force of the wind, I may mention that I have felt a good deal of surprise at what is, if I can trust my own estimations, the almost complete agreement of the observers. This remark must be understood to be limited to light or moderate winds, for at no station in the past year did I happen to encounter a wind of above force 6 of Beaufort's scale. At most stations, on writing down at intervals what I estimated the force of the wind to be, and then asking for the observer's estimate, I found it to agree to within ·5 of my own. The most marked exception was Dover, where I consider that in the case of moderate forces (the wind was blowing with force 5 while I was there), the observer has been in the habit of estimating the force a unit too low. In regard to Scilly, where the estimated forces seem certainly to be high as compared with the anemographic records, the observer estimated moderate winds in accordance with the usual scale of estimation, and so far as I could discover from questioning him, winds of high force also. At the stations at which anemometers are employed the observers seem to be frequently embarrassed by the large discrepancies between velocities calculated from their estimations and those actually recorded by the anemographs. I hope that I acted in accordance with the wishes of the Council in advising these observers, when estimating the force of the wind according to the scale, to forget as far as possible the existence of the anemographs. It was at one time my intention to take with me, when inspecting, a portable pressure-anemometer. I believe that had I employed such an instrument as a test of the observers' estimates, I should have found a discrepancy in the latter apparently greater than the unanimity which I have observed. Analysing the subjective impressions on which our estimation of the force of the wind depends, we find that these are produced in small measure by the sensation of the wind's impact upon the body. A complex idea of motion is derived from numerous simultaneous impressions, sound, the motion of trees, flags, the sails of vessels, smoke from chimneys, the drift of rain, spray, and dust, and the movements of

clouds near the earth's surface. The aggregate effect of these impressions may be surprisingly uniform in different observers, and yet may by no means tally with the traces produced b yan instrument which records solely, but exactly, the movement of the atmosphere which impinges upon the cups.

I may perhaps mention here that just as my experience (very limited, by the way, at present) has reversed my previous idea of the value of the system of estimated wind-force, so it has reversed a preconception as to another point. I now believe that of the observers at the inland stations the majority are disposed slightly to underrate, rather than to overrate, the force of the wind, as compared with those at the coast stations. It is possible that the observers at the inland stations are inclined to be a little too much on their guard against the over-estimation which might be natural to those who are accustomed only to comparatively light winds.

Sites for Anemometers.

The time is probably far distant when anemometers can be erected at so large a number of different stations, in diverse localities, that mean results derived from the anemographs will be of much value towards affording reliable estimates of the movements of the atmosphere over extensive districts; and at the present time I suppose that the erection of these instruments, in any but exceptionally exposed situations, will be attended with more expense than advantage. The only stations not provided with anemometers, at which the employment of these instruments would be productive of results, not merely interesting but valuable, are, in my opinion, Spurn Head, Hurst Castle, and Jersey. Of these Spurn is undoubtedly the most suitable, as regards exposure, being practically as well exposed as a ship anchored three miles from the shore.

Cloud Observation.

I must reluctantly state my opinion that the art of cloud observation is not much cultivated among the Council's observers at the stations in England. At five of the Stations of the Second Order (viz., Chatham, Folkestone, Geldeston, Hull, and St. Aubin's) the observers were absent at the time of my visit. At the others the observers in general manifested little inclination or aptitude for the study of the clouds. It would hardly be fair to apply this remark to the observers at those of the Telegraphic Reporting Stations which are situated on the coast. Coastguard officers and men, and lighthouse keepers, form the material for an admirable corps of cloud observers. They are, for the most part, somewhat keenly interested in the subject. But they exhibit and complain of inability to distinguish with accuracy the different forms of cloud. I believe that these observers would welcome, and most usefully employ, some plain and simple handy book of cloud observation adapted for their use. The items of personal instruction which can be conveyed during an Inspector's visit are necessarily small. At present the observers who appear to me to show most aptitude for this special branch of work are those at Scilly and Hurst, and of the Second Order Stations the observer at the Ordnance Survey Office (Southampton).

Sea Disturbance.

The opportunity for observing the state of the sea is very good indeed at Spurn Head, good at Scilly, Prawle Point, Hurst, Dover, and Yarmouth; fairly good at Jersey and Shields; less so at Bidston Observatory.

Photography.

The photography at Falmouth Observatory, at the time of my visit, was by no means satisfactory. I do not know whether the defect was due to inferiority of chemicals, or whether the extreme whiteness of the walls in the rooms, which had been white-washed, may have contributed to this result.

New Station.

Since the new Telegraphic Reporting Station at Hawes Junction is not, at the time of writing this Report, in full working order, it would be premature to speak unreservedly of the value of the station. It has been unfortunate that the Midland Railway station-master at Hawes Junction, who, I think, would have probably been a good observer, was removed from the station on December 26, a new man, who was totally ignorant of meteorological work, having been appointed to the office. After setting up the instruments in their places I spent a day in the instruction of the new official, whom I was permitted, through the courtesy of the Midland Railway Company, to send for, a few days before his removal to Hawes Junction. He is intelligent, and may in a short time prove a good observer. By levelling from the nearest Ordnance Survey marks I determined the height of the cistern of the barometer as 1,135½ feet above mean sea level. I have just received a letter from Mr. Allport, General Manager of the Midland Railway, who has spared no pains in promoting the establishment of the meteorological station, to the effect that one of the company's engineers has determined the level of the railway at Hawes Junction, about 7 feet below the barometer cistern, as 1,128 feet. It will therefore be seen that in a most important respect the station differs from the other Telegraphic Reporting Stations in England. One result of this difference will, as I apprehend, be found in the inaptitude of the barometrical reports from Hawes Junction for use, at least on some occasions, in drawing the isobars in the Daily Weather Maps, a matter of trifling consequence in comparison with the advantages likely to be derived from the unusual height of the station. I need not point out what I think these advantages to be, but I may instance that on December 18th and 19th, when barometrical readings were *very high*, I found

the readings of the barometers at Hawes Junction corrected and reduced to 32° and sea level, to be considerably lower than the readings of the barometers at the nearest meteorological stations in various directions similarly corrected and reduced.

The position of the reporting barometer at Hawes Junction is not very good, the only place in which a good light can be obtained and which is at the same time a safe place for the instrument, being a very small booking office, in which the alterations of temperature are often, in winter, rapid and extreme. I understand that it is likely that the Midland Railway Company will in the course of the present year either enlarge or rebuild the railway station, when a better site for the instrument may probably be secured.

The thermometer screen and rain-gauge have a moderately good exposure, on ground the slope of which from south-east to north-west, is very considerable.

I suspect that the deflections of the wind at Hawes Junction will prove to be greater and more varied than at any other of the Council's stations in England.

I think it probable that the above Report of the stations of the Meteorological Council in England will be found to contain some truisms and some inaccuracies, but I hope that neither are more numerous than may be expected in the remarks of one who is still, to some extent, a novice in the work which the Council have entrusted to his hands.

As regards that work I beg that you will communicate to me the wishes and instructions of the Council as to the special directions in which it can most advantageously be developed and improved.

Yours faithfully,
W. CLEMENT LEY.

To the Secretary of the Meteorological Council.

The draft scheme for the text of the Quarterly Weather Report (Minutes, p. 97), was re-submitted, and again revised with a view to its final adoption at next meeting.

The Secretary reported that 20 sunshine recorders had been received and issued to stations, and submitted a letter from Mr. Lecky (No. 109) tendering for the supply of curved cards, at 40*l.* for the first ten thousand, and 25*s.* per thousand afterwards, and also applying for an advance of 40*l.* on account.

Resolved—That Mr. Lecky's tender be accepted, and that the sum of 40*l.* be paid to him.

It was further resolved—(1.) That the number of cards of each kind to be ordered and the nature of the pigment to be employed be determined by Professor Stokes; (2.) That the observers be instructed to send to the Office the original curves, as well as their estimate of the duration of sunshine; (3.) That 10 additional glass spheres be ordered.

Read—Letter 108 from Mr. Lecky, inquiring if he was at liberty to supply frames on Professor Stokes' design, and if he could obtain glass spheres from the Office.

Resolved—That the Council have no objection to Mr. Lecky's supplying frames, and will allow him to receive one sphere from the Office.

Submitted—The following Reports—

December 31, 1879.

STATEMENT of WORK done in PANTAGRAPH ROOM during December.

Zinc Plates pantagraphed:—Barograms, 4 plates, Nos. 46–49, 1879; Thermograms, 5 plates, Nos. 49–53, 1879; Anemograms, 2 plates, Nos. 45–46, 1879; Rain Curves, 2 plates, Nos. 45–46; Vapour Tension, 4 plates, Nos. 45–48, 1879.

No *Copper Plates* have been engraved.

Photographic Curves are prepared to Plate 50 for barograms; the thermograms are not in advance of the zinc plates.

My own time has been mainly occupied on work connected with the harmonic analyser, and this, together with Mr. Cobley's absence through illness, accounts for the smaller output of pantagraph work.

The September tabulations have been examined, and the remark sheets were completed by the 4th. The October work was received from Mr. Allen on the 23rd, and the remark sheets are now in hand. Mr. Allen's report is attached.

(Signed) R. H. CURTIS.

R. H. Scott, Esq., F.R.S.

December 23, 1879.

STATEMENT of WORK done in the EXAMINATION ROOM since 28th November 1879.

The following curves and tabulations have been examined:—August, Aberdeen; October, all observatories (except the thermograms of three observatories done in November.)

(Signed T. E. ALLEN.

To R. H. Scott, Esq.,
Secretary, Meteorological Council.

January 1880.

STATEMENT of WORK done in MARINE ROOM during December 1879.

New Logs examined, eight in number.

Cape of Good Hope District.

Winds.—Chart of "improved" wind-roses drawn for January by aid of stencil plates, cut from values of the exponential curve supplied by Mr. Galton.

Barometer.—January and July means and range for single-degree squares obtained and charted.

Air Temperature.—Isotherms approximately drawn for January and July.

Currents.—Individual currents charted for May and June.

Proofs of lithograph for four representative months checked.

Sea Surface Temperature.—January means and range for single-degree squares obtained and charted.

Cape Gales.—Working of mean results completed for July.

Form compiled for synchronous observations on board Her Majesty's ships.

Collection of Data for the Indian Government.

The duplicate copy of data for July to December almost completed. All except supervision is done by outside assistance.

(Signed) CHAS. HARDING.
HENRY TOYNBEE,
Marine Superintendent.

R. H. Scott, Esq.

The following cheques for December were drawn on the 31st of that month:—

	£ s. d.	£ s. d.
Administration:		
R. H. Scott, salary	- -	66 13 4
J. S. Harding, jun. } Salaries and wages	27 15 6	
T. D. Bell }	12 15 6	
J. S. Harding, sen. }	*8 19 8	
		49 10 8
C. W. Jacques, rent No. 116	133 13 0	
" " No. 113	18 0 6	
		151 13 6
Pall Mall Coal Co., coals	- -	5 10 0
H. Bond & Son, repairs and furniture	- -	22 1 0
J. A. Curtis, drawing charts	- -	2 2 0
Pickford & Co., carriage of parcels	- -	1 0 8
Williams and Norgate, books	- -	2 5 7
Special Researches:		
Gauthier-Villars & Co., clichés	- -	3 5 5
Malby & Sons, globe	- -	13 0 0
R. W. Munro, harmonic analyser	- -	83 2 6
W. Thomas, Scilly anemometer	- -	2 10 4
G. M. Whipple, experiments at Kew	- -	17 9 6
Land Meteorology:		
D. Thomson, Aberdeen	53 0 2	
D. Sangster's account for repairs	2 7 6	
		55 7 8
T. R. Robinson, Armagh	46 19 0	
" (expenses)	7 14 6	
		54 13 6
W. L. Fox, Falmouth	- -	71 19 6
R. Grant, Glasgow	- -	58 14 6
H. Williams, Holyhead	- -	2 16 8
G. M. Whipple, Kew	- -	100 0 0
C. Clouston, Orkney	- -	3 4 8
G. H. Aird, Scaham	- -	2 13 10
S. J. Perry, Stonyhurst	- -	56 17 7
J. E. Cullum, Valencia	15 16 8	
" (expenses)	41 16 11	
		57 13 7
Carried forward	-	£884 6 0

* Four weeks ending 27th December.

	£ s. d.	£ s. d.
Brought forward -	- -	884 6 0
Land Meteorology—*continued.*		
J. O'Driscoll, rent, Valencia - - -	- -	25 0 6
G. T. Watson, Yarmouth - - -	- -	5 9 6
P. Adie, visit to Glasgow, &c. - - -	- -	4 12 4
T. Culleton, stencils - - - -	- -	1 8 8
J. Griffin & Sons, still - - - -	- -	3 1 6
Hopkin & Williams, chemicals - -	- -	2 9 5
Hughes & Kimber, cotton waste, &c. - -	- -	1 11 0
W. Marriott, meteorological returns - -	- -	25 0 0
Malby & Sons, anemometer forms - -	- -	16 2 0
R. W. Munro, repairs, &c. - - -	- -	1 7 0
R. H. Curtis - }	22 4 5	
J. A. Curtis - }	15 11 1	
T. E. Allen - } Discussion, &c. of Observations	15 11 1	
C. H. Thompson - }	*9 4 0	
E. G. Aldridge - }	*7 6 8	
		69 17 3
Weather Information and Forecasts:		
J. McCormack, Aberdeen (bonus) - -	- -	3 3 0
G. Carrick, Ardrossan - - - -	- -	1 0 1
H. Todd, Cambridge - - - -	4 11 3	
„ (bonus) - - - -	3 3 0	
		7 14 3
J. C. MacGowan, Donaghadee - - -	0 18 2	
„ (bonus) - - -	3 3 0	
		4 1 2
J. Costello, Dover - - - -	4 1 0	
„ (bonus) - - - -	3 3 0	
		7 4 0
W. Brand, Dunrossness - - -	3 18 3	
„ (bonus) - - - -	3 3 0	
		7 1 3
J. Tilston, Holyhead - - - -	4 0 0	
„ (bonus) - - - -	3 3 0	
		7 3 0
G. G. Appleton, Hurst Castle - - -	- -	0 18 0
A. P. Hay, Inverness - - - -	- -	1 6 0
J. Fisher, Jersey - - - -	4 5 6	
„ (bonus) - - - -	3 3 0	
		7 8 6
T. Curtayne, Killarney - - -	- -	0 15 0
G. Mitchell, Kingstown - - -	3 18 11	
„ (bonus) - - - -	3 3 0	
		7 1 11
P. Turnbull, Leith (bonus) - - -	3 3 0	
„ (Mr. Anderson's account) -	1 2 0	
		4 5 0
F. Gaster, London - - - -	3 18 0	
„ (bonus) - - - -	3 3 0	
		7 1 0
K. Kerr, Mullaghmore - - - -	4 1 0	
„ (bonus) - - - -	3 3 0	
„ (Conway's account) - - -	5 17 0	
		13 1 0
W. D. Penny, Nairn - - - -	4 4 6	
„ (bonus) - - - -	3 3 0	
		7 7 6
Carried forward -	-	£1,126 15 10

* Four weeks ending 27th December.

	£ s. d.	£ s. d.
Brought forward -	- -	1,126 15 10
Weather Information and Forecasts—*continued.*		
M. Mackintosh, Nairn - - -	- -	0 13 0
J. W. Irvine, N. Shields - - -	0 10 0	
„ (bonus) - - - -	3 3 0	
		3 13 0
E. J. Lowe, Notts - - - -	- -	3 18 0
J. E. Bellamy, Oxford - - -	- -	3 11 6
G. Blackler, Prawle Point - - -	3 5 0	
„ (bonus) - - - -	3 3 0	
		6 8 0
W. Kennedy, Roche's Point - - -	0 7 0	
„ (bonus) - - - -	3 3 0	
		3 10 0
J. C. Walker, St. Ann's Head - - -	0 14 0	
„ (bonus) - - - -	3 3 0	
		3 17 0
W. Thomas, Scilly - - - -	4 19 10	
„ (bonus) - - - -	3 3 0	
		8 2 10
R. W. Scaddard, Scilly - - -	- -	0 14 0
J. Sibert, Spurn Head - - -	- -	4 7 5
J. Sutherland, Stornoway - - -	5 11 6	
„ (bonus) - - - -	3 3 0	
		8 14 6
J. Sinclair, Wick - - - -	3 5 0	
„ (bonus) - - - -	3 3 0	
		6 8 0
J. Murray, Wick - - - -	- -	1 6 0
G. T. Watson, Yarmouth - - -	4 10 10	
„ (bonus) - - -	3 3 0	
		7 13 10
A. Guy, York - - - - -	- -	3 18 0
P. Adie, station barometers - - -	- -	40 10 0
H. A. Hankey, portion of anemometer -	- -	22 0 0
Postmaster General, telegrams, October -	- -	178 5 0
G. M. Whipple, verifications - - -	- -	3 12 0
F. Gaster -	31 13 6	
W. L. Dallas - } Preparation and issue of Reports,	19 15 1	
F. Brodie - } &c.	18 13 8	
H. W. Chivers	*6 12 0	
		76 14 3
Inspections:		
A. Buchan, salary - - - -	- -	37 10 0
W. C. Ley, salary - - - -	- -	37 10 0
For Ocean Meteorology:		
Captain H. Toynbee - - - -	33 6 8	
R. Strachan - -	27 15 6	
C. Harding - - } Discussion, &c. of observations, and care of instruments.	22 4 5	
H. Harries - -	*11 4 0	
Lieut. C. W. Baillie -	16 13 4	
		111 3 11
B. M. Allingham		1 16 4
S. A. Harding - } Observations for India Office - -		3 1 6
E. I. Strachan -		1 9 9
P. Adie, repairing "A." barometers - -	13 10 6	
„ "B.T." „ - -	95 2 0	
		108 12 6
Carried forward -	-	£1,815 16 2

* Four weeks ending 27th December.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	1,815	16	2
For Ocean Meteorology—*continued.*						
G. M. Whipple, verifications - - -	8	5	0			
,, ,, - - -	2	8	0			
				10	13	0
W. E. Fry, Cape observations - - -	-		-	1	18	9
Malby & Sons, copper plates, charts, &c. -	-		-	12	12	6
J. H. Woodstock, packing cases - -	-		-	3	6	0
Miscellaneous:						
Keller, Wallis, & Postlethwaite, commissions -	-		-	1	13	1
Malby & Sons, commissions - - -	-		-	3	3	3
J. S. Harding, jun., petty cash - - -	100	0	0			
,, ,, - - -	80	0	0			
				180	0	0
				£2,029	2	9

The Secretary reported the progress of the trials made with the Harmonic Analyser, and was instructed to direct Mr. Curtis, in the continuance of his work, to read all the cylinders on arriving at each midnight, beginning with July 1877.

The Council then adjourned.

116, *Victoria Street, January* 24, 1880.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. GALTON.	GENERAL STRACHEY.
PROFESSOR STOKES.	THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of last meeting (January 10) were read and confirmed.

Read the following letter:—

No. 21076.
M.O. 154.

SIR, Treasury Chambers, January 14, 1880.

THE Lords Commissioners of Her Majesty's Treasury, having had before them your letter of the 17th ultimo, stating that the attention of the Meteorological Council has been called to a circular, of which you enclose a copy, the ultimate object of which appears to be to bring under the notice of this Department the course pursued by the Meteorological Office in making special arrangements for supplying information to three of the London newspapers, the "Times," "Standard," and "Daily News," I am desired to state in reply that so long as the expense of the Meteorological Council upon its service is confined within the vote annually taken pursuant, to the Treasury Minute of 23rd May 1877, my Lords are satisfied to leave to the Council's own discretion its arrangements with the Press, equally with all other details which are not prescribed in the same Minute.

I am, &c.

The Secretary to the Meteorological Council. (Signed) R. R. W. LINGEN.

The Reports of the Inspectors for England and Scotland (printed on last Minutes) were considered.

With reference to Mr. Buchan's report, the Secretary stated that a Stevenson's thermometer screen had been sent to Stornoway, and that a supply of barometers, with uncontracted tubes, had been procured, as already mentioned (Minutes, p. 81), with a view to their issue to telegraphic stations, as opportunity of safe carriage offered.

Professor Stokes submitted the following Memorandum relating to the use of barometers with contracted tubes:—

WITH reference to one passage in Mr. Buchan's report, I must observe that the point which he laid before the Meteorological Council respecting the sluggishness of marine barometers, in his former report, was perfectly well understood by them; and it was precisely with a view to investigate that point that I instituted the experiments and calculations detailed in my Memorandum (Minutes, 1878, p. 131). It is perfectly true that the experiments were made with comparatively speaking very large differences of height of the falling mercury from the equilibrium height, but the object of those experiments was to lay a foundation for a mathematical calculation from which the effect of sluggishness might be deduced in cases where the differences are such as those which Mr. Buchan contemplates. The rule arrived at is very simple, namely, that, except in the case of rapidly recurring fluctuations, the effect of sluggishness will be allowed for by taking an observed reading of the barometer to represent the barometric height, not at the moment of observation, but at a time earlier by a certain interval T, which I called the "lagging time," which is ordinarily something like three or four minutes, and is a constant belonging to each barometer, which may be easily calculated from the time the mercury took to fall from 1·5 to 0·5 inch above the true height when the barometer was tested for sluggishness.

It is only when the height of the barometer is subject to very rapid *oscillations* (whether, on the whole, the barometer be rising, falling, or stationary), that the rule fails to give that portion of the whole height which is due to the small oscillation superposed on the general rise or fall.

The error arising from sluggishness in a rising or falling barometer is, however, associated with another, not depending upon sluggishness, and equally affecting a barometer which is not contracted, namely, the irregularity in the correction for capillarity due to an irregularity in the angle of contact of the mercury with the glass. I do not believe that this would be sensible with a barometer in proper condition, though it would be otherwise if the glass were at all dirty or the mercury in the tube showed the least film on its surface. This is, however, quite distinct from the error of sluggishness; and though it affects a barometer with uncontracted tube, the latter has certainly the advantage that the error may be at once removed by tapping, which is not the case with a marine barometer, unless it be tapped at frequent intervals during the space of a few minutes.

G. G. STOKES.

The Secretary was instructed to forward a copy of this Memorandum to Mr. Buchan.

With reference to the paragraph "Wind observations" in Mr. Ley's report, it was

agreed that it is desirable to supply the stations with some simple form of instrument for observing wind force.

The following amended draft scheme for the Quarterly Weather Report (Minutes, January 10) was submitted and adopted:—

SIR, Meteorological Office, December 13, 1879.

REFERRING to Minutes, 1879, p. 79, I beg to submit herewith a plan for the preparation of the Quarterly Weather Report.

I am, &c.

The Secretary, (Signed) FREDC. GASTER.
Meteorological Council.

SUGGESTIONS for the PREPARATION of the QUARTERLY WEATHER REPORT.

The Report, though issued quarterly, and containing a quarterly summary of rainfall and temperature, to consist of three monthly sections, each section to contain:—

A. A brief summary of—
1. The general distribution of pressure over the British Isles.
2. The chief changes which have occurred in the same, marking the prevalence of distinct systems of weather, and referring, briefly, to—
(*a.*) The movements and main features of all the more important areas of low pressure observed over and near our islands.
(*b.*) The movements and main features of all the more important areas of high pressure.

To be illustrated by two small charts, showing—
1. The mean pressure over the British Isles (by isobars).
2. The movements of the areas of low pressure referred to above.

B. A careful examination of—
The areas of high and low pressure referred to in summary A., describing the gales experienced, showing effects produced on weather, and referring to the curves on the plates as may be found expedient.

To be illustrated by small synoptic charts engraved on the sides of the plates.

C. Brief notes as to the general distribution of temperature during the month, and as to the extremes observed.
Notes as to sudden and considerable changes of temperature referring (as far as may be) to the causes which produced them (section B.).

To be illustrated by a small chart, showing the mean isotherms for the month.

D. Brief notes as to distribution of cloud, vapour tension, relative humidity (or its complement) and rainfall, mentioning very heavy falls and unusual droughts, and referring to the causes which produced them (section B.)

To be illustrated by a small map, showing the distribution of rain.

E. Brief notes as to relative prevalence of wind from each of the eight principal points.

To be illustrated by a small map, with a wind-rose (or star) for the principal stations.

APPENDIX. To contain tables as follows:—
1. Monthly means of the meteorological elements for all telegraph stations.
2. „ „ „ for stations of the second order.
3. „ „ „ for the seven observatories.
4. Five-day means of pressure and temperature.

(Forms of tables to be submitted.)

PLATES of curves, &c., with 8 a.m. charts engraved for each day.

In the last Quarterly Report for each year—
(1.) A classified catalogue of all the more important types of weather experienced during the year.
(2.) A general index.

Mr. Gaster was directed to submit at the next meeting a specimen of the Quarterly Weather Report for 1876, treating one month according to the above scheme.

The following amended draft (Minutes, p. 97) of the Quarterly Summary of Rainfall and Temperature (1st quarter) was submitted and approved generally:—

Meteorological Office, London,
SIR, January 9, 1880.

THE accompanying specimen of the "Quarterly Summary of Rainfall and Temperature" over the British Islands has been prepared in the following manner:—

1.—RAINFALL.

The mean values for the Rainfall in the various districts were obtained from observations made at the following stations—

For the years 1866 to 1877.

Districts.	Stations.
0. Scotland, N.	Loch Broom.
	Helmsdale.
	Sandwick Manse.
1. Scotland, E.	Inverness.
	Aberdeen.
	Ballater.
	Logierait.
	Stirling.
	Hawick.
2. England, N.E.	N. Shields.
	York.
	Grimsby.
	Boston.
3. England, E. (1866 to 1875.)	Fakenham.
	Beccles.
	Witham.
	Bury St. Edmunds.
3. England, E. (1876 and 1877.)	Yarmouth.
	Cambridge.
	Bury St. Edmunds.
4. Midland Counties	Leicester.
	Derby.
	Tenbury.
	Shiffnal.
	Cirencester.
	Banbury.
	Hitchin.
5. England, S.	Bridport.
	Selborne.
	Maidstone.
	London (Camden Town.)
6. Scotland, W.	Dumfries.
	Ayr.
	Castle Toward.
7. England, N.W. and N. Wales.	Llandudno.
	Manchester.
	Skipton.
8. England, S.W. and S. Wales.	Barnstaple.
	Bodmin.
	Haverfordwest
	Rhayader.
9. Ireland, N.	Galway.
	(Doo Castle), Bunninadden, Co. Sligo.
	Waringstown.
	Strabane.
10. Ireland, S.	Cork.
	Waterford.
	Killaloe.
	Portarlington.
	Monkstown, Co. Dublin.

(These values were obtained mainly from Symons' Monthly Meteorological Magazine, supplemented by some of the values contained in the Reports of the Rainfall Committee of the British Association, 1868–1876.)

When the returns from any station failed, the vacancies were supplied in one of the following manners :—

A. When the vacancy was of long duration, the values were taken from the records at some near station, where the *mean annual fall* was about equal to that of the station for which the values were wanting.*

B. By ascertaining the variations in the amount of fall which had taken place at adjacent stations during the interruption in our returns, and interpolating a value for the vacant space.†

For the years 1878 and 1879 the values have been obtained from stations the returns from which are published in the Weekly Weather Report. These stations are now as follow, but were not always quite so numerous.

Districts.	Stations.
0. Scotland, N.	Sumburgh Head.
	Stornoway.
	Wick.
1. Scotland, E.	Nairn.
	Aberdeen.
	Glenalmond.
	Leith.
2. England, N.E.	Shields.
	Durham.
	York.
	Spurn Head.
	Kelstern (Lincolnshire).
3. England, E.	Yarmouth.
	Cambridge.
	Audley End (Saffron Walden).
	Rothamstead.
4. Midland Counties	Nottingham.
	Loughborough.
	Leicester.
	Shrewsbury.
	Hereford.
	Cirencester.
	Oxford.
5. England, S.	London.
	Marlborough.
	Strathfield Turgiss.
	Dover.
	Hastings (St. Leonard's).
	Hurst Castle.
6. Scotland, W.	Laudale (Loch Sunart).
	Glasgow.
	Ardrossan.
	Silloth (Cumberland).
	Douglas (Isle of Man).
7. England, N.W.	Stonyhurst.
	Manchester (Prestwich.)
	Liverpool Observatory (Bidston).
	Holyhead.
8. England, S.W.	Pembroke.
	Barnstaple.
	Falmouth.
	Plymouth.
	Prawle Point.
9. Ireland, N.	Londonderry.
	Mullaghmore.
	Markree Castle.
	Brookeborough.
	Armagh.
	Donaghadee.
10. Ireland, S.	Dublin.
	Kingstown.
	Parsonstown.
	Roche's Point.
	Valentia.
	Foynes.

* This plan was adopted in the cases of Stirling, Logierait, Inverness, Loch Broom, and Ayr.

† This plan was followed in all cases where the omissions were trifling.

A comparison has been made for this (first) quarter for the years 1878 and 1879, between the values obtained from the two sets of stations named above, and the following are the results:—

		1878.	1879.
		ins.	ins.
0. Scotland, N.	Stations in 1st list	8·8	5·7
	„ „ 2nd „	4·0	5·3
1. Scotland, E.	Stations in 1st list	4·6	5·8
	„ „ 2nd „	4·3	7·0
2. England, N.E.	Stations in 1st list	4·0	4·4
	„ „ 2nd „	4·9	5·2
3. England, E.	Stations in 1st list	Returns not available.	
	„ „ 2nd „	4·6	6·3
4. Midland Counties	Stations in 1st list	4·0	6·2
	„ „ 2nd „	3·8	6·2
5. England, S.	Stations in 1st list	4·9	8·3
	„ „ 2nd „	4·9	8·3
6. Scotland, W.	Stations in 1st list	9·1	7·3
	„ „ 2nd „	11·0	8·5
7. England, N.W.	Stations in 1st list	8·1	6·9
	„ „ 2nd „	7·3	6·7
8. England, S.W.	Stations in 1st list	7·7	11·1
	„ „ 2nd „	6·2	11·2
9. Ireland, N.	Stations in 1st list	7·8	7·6
	„ „ 2nd „	8·2	6·7
10. Ireland, S.	Stations in 1st list	7·0	9·9
	„ „ 2nd „	7·9	11·4

The comparison could not be made for a greater number of years owing to want of information from stations in the second list.

It will be seen that in the hilly districts, such as Scotland, N. and W., and England, N.W., the agreement is not so good as could be desired, but it is very doubtful whether any better agreement (for single years) would be arrived at, even if the stations had in each case been more numerous. In the more level countries the agreement is much better, and in some cases (viz., the Midland Counties and England, S.) it is quite remarkable.

2.—Temperature.

The temperature values given in the table have been obtained from the following stations:—
For the years 1866–1867 the returns from the following stations were used—

Districts.	Stations.
0. Scotland, N.	Sandwick Manse.
	Stornoway.
	Dunrobin.
1. Scotland, E.	Culloden.
	Aberdeen.
	Perth.
	Leith.
2. England, N.E.	Bywell.
	N. Shields.
	Hull.
3. England, E.	Royston.
	Holkham.
	Norwich.
	Wisbeach.
	Somerleyton.
4. Midland Counties	Derby.
	Nottingham.
	Cardington.
	Oxford.
5. England, S.	Marlborough.
	Greenwich.
	Streatley.
	London (Camden Town).
	Weybridge.
	Strathfield Turgiss.
	Osborne.
	Bournemouth.
	Worthing.
6. Scotland, W.	Greenock.
	Cockermouth.
	Silloth.
	Carlisle.
7. England, N.W. and N. Wales.	Stonyhurst.
	Bradford.
	Leeds.
	Eccles.
	Liverpool.
	Llandudno.
8. England, S.W. and S. Wales.	Gloucester.
	Taunton.
	Barnstaple.
	Truro.
	Helston.
9. Ireland, N.	1866 to 1873: Belfast.
	1866 to 1873: Milltown (Banbridge).
	1866 to 1873: Armagh.†
	1866 to 1873: Athlone.*
	1866 to 1877: Moville.
	1866 to 1877: Milltown.
	1866 to 1877: Armagh.
	1866 to 1877: Donaghadee.
10. Ireland, S.	1866 to 1873: Dublin.*
	1866 to 1873: Curragh Camp.
	1866 to 1873: Buttevant.*
	1866 to 1873: Cork.
	1866 to 1873: Valentia.†
	1874 to 1877: Kingstown.
	1874 to 1877: Parsonstown.
	1874 to 1877: Cork.
	1874 to 1877: Roche's Point.
	1874 to 1877: Valentia.

In cases where the returns were incomplete the vacancies have been supplied by plotting for the particular year and quarter the mean values for adjacent stations, and then supplying by interpolation the probable value for the station requiring it.

The values were obtained mainly from the returns published quarterly by the Registrar General and those published by the Scottish Meteorological Society, in their Quarterly Journal, and the reports of the Army Medical Department, besides the records of the two Irish observatories, Valentia and Armagh. The returns for Cork were furnished by R. Caulfield, Esq., LL.D.

The values for the years 1878 and 1879 are obtained from the returns received from the stations named in the Weekly Weather Report, a list of which has already been given on p. 119.

A rough comparison has been made for the years 1878 and 1879 between the values obtained from these two sets of stations, and the difference between them was so trifling that it was not thought worth mentioning.

I am, &c.
(Signed) Frederic Gaster.

* Did not commence till January 1867.

† Did not commence till January 1869.

SUMMARY of RAINFALL and TEMPERATURE for the First Quarter of the Year (January 1 to March 31).

CHART SHOWING DISTRICTS.

		PRINCIPAL WHEAT PRODUCING DISTRICTS.							PRINCIPAL GRAZING, &c. DISTRICTS.						BRITISH ISLANDS GENERALLY.
		0. SCOTLAND, N.	1. SCOTLAND, E.	2. ENGLAND, N.E.	3. ENGLAND, E.	4. MIDLAND COUNTIES.	5. ENGLAND, S.	MEAN FOR ALL THE WHEAT-PRODUCING DISTRICTS.	6. SCOTLAND, W.	7. ENGLAND, N.W.	8. ENGLAND, S.W.	9. IRELAND, N.	10. IRELAND, S.	MEANS FOR ALL THE GRAZING, &c. DISTRICTS.	
RAINFALL (in inches).		ins.	ins.	ins.	ins.	ins.	ins.	ns.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
	1866	14·8	11·3	5·8	7·4	7·1	11·4	9·6	15·4	13·4	16·9	13·7	12·0	14·3	11·7
	1867	10·7	9·5	5·4	5·7	8·1	8·8	8·0	9·9	11·1	15·2	11·8	10·7	11·7	9·7
	1868	19·1	11·7	4·9	5·4	6·7	7·5	9·2	17·6	13·3	11·9	13·0	10·5	13·3	10·1
	1869	11·8	8·9	6·2	6·2	7·7	9·0	8·3	11·4	12·2	14·0	12·1	12·1	12·4	10·1
	1870	6·4	6·7	4·8	3·9	5·1	6·0	5·5	8·8	9·0	10·7	8·6	9·7	9·4	7·2
	1871	9·4	6·9	3·8	3·9	4·8	6·1	5·8	11·7	8·7	10·0	10·7	9·4	10·1	7·8
	1872	8·2	11·2	7·8	6·1	9·8	10·1	8·9	15·2	14·0	19·5	12·7	13·1	14·9	11·6
	1873	7·9	7·2	5·3	5·4	7·1	8·4	6·9	10·0	9·6	14·1	8·8	11·9	10·9	8·7
	1874	11·5	6·5	3·5	3·1	5·7	4·4	5·8	8·6	11·0	12·5	8·4	7·7	9·6	7·5
	1875	8·4	7·0	3·9	3·7	5·8	6·7	5·9	9·8	8·7	12·6	7·1	10·2	9·7	7·6
	Means for 10 years 1866–1875	10·8	8·7	5·1	5·1	6·8	7·8	7·4	11·8	11·1	13·7	10·7	10·7	11·6	9·3
	1876	13·4	9·5	6·3	6·7	8·2	7·5	8·6	12·1	12·0	10·9	10·0	10·0	11·0	9·7
	1877	11·9	9·8	7·1	7·6	8·3	10·7	9·2	14·2	15·4	14·2	13·4	11·4	13·7	11·3
	1878	8·0	4·3	4·9	4·6	3·8	4·9	5·1	11·0	7·3	6·2	8·2	7·9	8·1	6·5
	1879	5·3	7·0	5·2	6·3	6·2	8·3	6·4	8·5	6·7	11·2	6·7	11·4	8·9	7·5
Means for 14 years, 1866–1879		10·5	8·4	5·4	5·4	6·7	7·8	7·4	11·7	10·9	12·8	10·4	10·6	11·3	9·1
TEMPERATURE (in degrees Fahrenheit.)		°	°	°	°	°	°		°	°	°	°	°	°	°
	1866	38·3	38·8	39·1	40·9	40·4	41·9	39·9	40·0	40·6	43·4	39·9	40·3	40·8	40·3
	1867	36·9	37·2	36·8	38·6	38·2	39·2	37·8	37·7	38·6	41·4	38·1	39·9	39·1	38·4
	1868	40·7	41·7	41·1	41·4	41·9	42·0	41·5	42·3	42·4	44·4	42·1	44·3	43·1	42·2
	1869	40·0	40·3	40·6	41·1	41·2	42·0	40·9	42·0	42·1	45·1	42·9	44·6	43·3	42·0
	1870	37·9	37·4	37·1	37·4	38·0	38·2	37·7	38·6	38·7	41·3	39·8	41·6	40·0	38·7
	1871	40·0	39·7	38·8	39·2	40·1	40·3	39·7	40·0	40·0	43·3	41·6	43·4	41·7	40·6
	1872	40·9	40·9	41·3	42·3	42·9	43·7	42·0	42·9	43·3	46·1	42·4	44·5	43·8	42·8
	1873	39·0	38·4	38·5	38·9	39·1	39·9	39·0	39·2	39·7	42·6	39·8	41·0	40·5	39·6
	1874	41·7	41·8	41·3	40·4	41·0	42·0	41·4	42·3	41·8	45·0	42·8	45·2	43·4	42·3
	1875	39·5	39·0	38·8	38·6	39·2	40·2	39·2	39·8	40·2	42·9	41·6	44·6	41·8	40·4
	Means for 10 years 1866–1875	39·5	39·5	39·3	39·9	40·2	40·9	39·9	40·5	40·7	43·6	41·0	42·9	41·8	40·7
	1876	38·7	38·3	39·2	39·0	38·9	40·0	39·0	39·5	39·8	42·4	40·1	43·3	41·0	39·9
	1877	38·4	38·8	40·4	41·7	41·8	43·1	40·7	40·5	41·8	44·9	41·4	45·2	42·8	41·6
	1878	40·0	40·1	40·8	40·6	41·8	41·7	40·8	41·9	42·2	44·2	42·5	45·1	43·2	41·9
	1879	34·0	34·2	35·9	36·5	36·4	37·8	35·8	36·5	36·8	40·8	38·0	40·5	38·5	37·0
Means for 14 years, 1866–1879		39·0	39·0	39·3	39·8	40·1	40·9	39·7	39·9	41·2	43·1	40·9	43·1	41·6	40·6

TABLE, showing, for the WHEAT and GRAZING DISTRICTS, and for the COUNTRY generally, the DATES of the COLDEST and WARMEST, and the DRIEST and WETTEST corresponding Quarters for the 14 years, 1866–79.

—	WHEAT DISTRICTS.		GRAZING, &c. DISTRICTS.		GENERALLY.	
		inches.		inches.		inches.
Driest	1878	5·1	1878	8·1	1878	6·5
Wettest	1866	9·6	1872	14·9	1866	11·7
		°·8		°·5		°·0
Coldest	1879	35	1879	38	1879	37
Warmest	1872	42°·0	1872	43°·8	1872	42°·8

It was resolved that this summary be published in the volume of the Weekly Weather Report for 1879, and that a proof of the complete summary be submitted as soon as possible.

The Secretary submitted a report on the results of the Hay Harvest Forecasts, which was ordered to be printed.

Professor Stokes exhibited specimens of cards for the Sunshine Recorder, showing comparative results obtained with different pigments. He was authorised to select for adoption the cards which he might ultimately prefer.

The Secretary was instructed to write to Mr. G. J. Symons, F.R.S., (Letter 237), offering a grant of 200*l.* if he would compute, and publish under the authority of the Office, monthly means of rainfall at the stations organised by him for the 15 years, 1866–80 inclusive.

Read the following letter :—

No. 1471.
M.O. 127.

SIR, Calcutta, December 16, 1879.

THE Government of India has recently sanctioned, as a part of an extended system of Marine Meteorology in connexion with this Office, the collection of ship's observations in these seas from and after the 1st January 1879, the object being to lay down these observations on Synoptic Charts, together with those of the continental and insular land stations.

2. Among the best and most valuable of such observations are those recorded by the commanders who work in connexion with your Department, and I have therefore to ask you to favour me with an estimate of the annual cost of reducing and copying these observations that relate to the Squares 326 to 331, 27 to 31, 63 to 67, and 99 to 103. On receipt of your reply an application will be made through the Government for permission to have the required data extracted.

I have, &c.
(Signed) HENRY F. BLANFORD,
Meteorological Reporter to the Government of India.

The Secretary to the Meteorological Council.

Read—A memorandum from Captain Toynbee reporting that since the last meeting four logs had been received, three of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Captain Archibald Campbell.	S.S. "Ethiopia"	July 25,1879—Jan. 9, 1880.	Glasgow to New York, 5 voyages.	1873, p. 43.
Capt. C. M. Dobson	S.S. "Sunbeam"	Jan. 7, 1879—Jan. 7, 1880.	Constantinople, India, China, New York.	1878, p. 49.
Capt. E. Carl V. Heggum.	"Blythewood"	Apr. 12,1879—Jan. 7, 1880.	Dundee, Calcutta, and home.	1878, p. 79.

Mr. Scott was instructed to convey the best thanks of the Council to the above-named observers.

The amended form for the 0h. 43m. synchronous observations, to be taken on board Her Majesty's Ships (Minutes, p. 84) was submitted and adopted.

Read an application (Letter 2598, 1879) from the Rev. N. Lawrence, British Chaplain, Patras, for the loan of instruments.—Declined.

Read an application (Letter 3072, 1879) from Mr. A. Cohen, British Consul at St. Paolo de Loanda, for the loan of instruments. The Secretary was instructed to transmit the application of Mr. Cohen to the Royal Geographical Society, with a request that it might be considered by them.

Submitted an application from the Chamber of Commerce at Wick (Letter 195) for the supply of Storm Warnings.—Granted.

Submitted an application (Letter 1748, 1879) from Messrs Brodie, T. D. Bell, and Francis for an increase of 10*l.* in their pay for the current year, instead of the increase granted (Minutes, p. 51) of 7*l.* to Mr. Brodie, and 5*l.* in each of the other cases.

The application was granted; but it was agreed that in future the Council can only consider themselves bound, with respect to augmentations of salary, by agreements expressly made by themselves, or by the Meteorological Committee.

Reported that the newly established Office for Maritime Meteorology in Sweden had forwarded to this Office specimens of its Log-Books, with instructions and with charts the Baltic subdivided into numbered squares.

The Secretary reported that he had received from Dr. Neumayer, at Hamburg, official copies of the report of the recent Arctic Conference held in that town, and had for-

warded two of them to the Hydrographic Office and to the Royal Geographical Society respectively.

Submitted—The following statement of accounts for the nine months ending 31st December 1879 :—

Income.	£ s. d.	£ s. d.
Balance from year 1878–9		709 9 10
Vote for year 1879–80:		
Amount paid	10,125 0 0	
„ unpaid	4,375 0 0	
		14,500 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses		12 3 11
(2.) Special researches (Hoffmeyer's charts and sun apparatus)		17 17 6
(3.) Observatories and stations		8 12 6
Supply of Information:		
Special reports for "Times," "Standard," and "Daily News"	630 8 6	
D. W. Charts and ordinary Forecasts	271 19 10	
Telegrams supplied to Hamburg	249 8 0	
Ordinary weather information for Press Agencies, &c.	87 19 8	
		1,239 16 0
Ocean Statistics (India Office, &c.)		357 13 2
Miscellaneous data		2 18 6
Sale of Instruments, &c.:		
Royal Navy account	38 10 0	
Mercantile Marine do.	57 3 6	
		95 13 6
Commission charged on work done for Colonies, &c.		9 4 0
		£16,953 8 11

Expenditure.	£ s. d.	£ s. d.
Administration:		
Payment of Council	750 0 0	
Secretary	600 0 0	
Salaries and wages	529 0 8	
Rent, fuel, and lighting	607 14 1	
Incidental and contingent expenses	525 6 0	
		3,012 0 9
Special Researches and Experiments		*603 11 6
Land Meteorology:		
Observatories and stations	1,874 14 0	
Discussion and reduction of observations	1,057 19 3	
		2,932 13 3
Weather Information and Forecasts:		
Telegraphic reports and storm warnings	2,320 7 10	
Preparation and issue of reports and forecasts	1,288 18 6	
		3,609 6 4
Inspections:		
Salaries and travelling expenses		433 15 7
Ocean Meteorology:		
Discussion and reduction of observations	1,497 14 7	
Expenses incidental to the supply of instruments:		
Care and issue of instruments	150 0 0	
Royal Navy	229 10 11	
Mercantile marine	438 11 7	
Distant island and coast stations	22 4 7	
		2,338 1 8
Balance		4,023 19 10
		£16,953 8 11

Liabilities.	£ s. d.
To Post Office (partly estimated)	376 8 1
„ Council	743 4 3
„ sundry creditors	705 11 7
„ „ (contracts or work uncompleted)	391 0 6
„ balance	4,023 19 10
	£6,240 4 3

Assets.	£ s. d.
By cash at bank	1,163 2 10
„ „ at Office	225 10 9
„ „ at Valencia	50 0 0
„ H.M. Exchequer	4,375 0 0
„ sundry debtors	426 10 8
	£6,240 4 3

* The sum of 150*l.* to be eventually transferred to this head from other accounts. No allowance yet made for payment to Rev. W. C. Ley for "Aids to Study of Weather."

The Council then adjourned.

116, *Victoria Street, February* 7, 1880.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	PROFESSOR STOKES.
MR. GALTON.	GENERAL STRACHEY.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (January 24) were read and confirmed.

The Secretary reported with reference to the subject of the supply of Forecasts to newspapers (Minutes, January 24), that he had had an interview with an agent of the Press Association (Limited), who wished to issue a circular to newspapers (Letter 277), inviting subscriptions for the 8 p.m. Forecasts.

Resolved—That Mr. Scott be authorised to obtain leave to confer officially with the Solicitor to the Treasury on certain questions arising out of the recent correspondence between the Treasury and the Office, and that if leave be obtained, the Chairman and Mr. Scott have an interview with the Solicitor to the Treasury.

The Secretary submitted the following Memorandum with reference to Mr. Blanford's application (Minutes, January 24).

ESTIMATE of ANNUAL COST of supplying a COPY of MARINE METEOROLOGICAL OBSERVATIONS taken in part of INDIAN OCEAN.

Mr. Blanford's letter of 16th December 1879 does not state whether merely one synchronous observation a day is required, or whether he wishes for a more detailed copy of log,—say all four-hourly observations. A statement will therefore be given of the cost of the different methods of working.

For the part of the sea mentioned in Mr. Blanford's letter (see enclosed chart, enclosure A.) we have on an average about 2,500 days' observations in each year, these observations being contained in about 70 different logs.

If a single observation per day is sufficient, at one special time, similar to that now supplied to General Myer of the U.S. Signal Service, the cost would be about 16*l.* for reducing and copying the observations on to forms similar to that attached (enclosure B.).

If the time selected is 0.43 p.m. G.T., and the data given on our synchronous forms are sufficient (see form attached, enclosure C.) the above amount would be somewhat reduced, since many ships now fill up the synchronous sheet, and in that case we could copy, after careful scrutiny, and enter the necessary corrections.

If the four-hourly observations are required, the cost would be about 65*l.* to produce a copy of the *corrected* observations.

If we merely give a copy (after careful scrutiny) of log for four-hourly observations, and a statement of all the necessary corrections to be applied, the cost will about 40*l.*

If we copied into logs we should require about 25 books for the observations of each year. No account has been taken in the above estimate of the cost of books or forms.

CHARLES HARDING.

Captain Toynbee, February 6, 1880.
Marine Superintendent.

Resolved—That Mr. Scott inform Mr. Blanford, in reply to his letter, that the Office, having at present some spare space at its disposal, which it can appropriate to the work of extracting logs, can furnish the information required at a cost of 100*l.* for each year; but that in future years it might be necessary to hire a room for the purpose, and that this would involve an increase in the cost. The Council, however, request Mr. Blanford to consider, before making any final arrangement for the future, how far it might be possible for him to obtain copies of such portions of the logs as he may require from the ships observing for the Office, upon their arrival at Calcutta or Bombay.

The Secretary was instructed to forward a supply of forms for the observations at 0h. 43m. p.m., to the Secretary to the Admiralty, in reply to his letter (Minutes, p. 69).

Submitted the following report on the Hay Harvest Forecasts (p. 72) :—

REPORT on the HAY HARVEST FORECASTS, 1879.

SIR,

THE returns relating to the Hay Harvest Forecasts being now complete, I beg to submit the results of the experiment, as reported by the various observers. No attempt has yet been made to compare these results with the *general character of the weather in each district as shown by our own charts*, although it should be borne in mind that the forecasts were drawn up for *districts*, not localities.

The forecasts were telegraphed daily for spaces of time varying from a month to six weeks * to about 30 persons practically engaged in Agriculture, and the returns furnished by the recipients, of the actual weather experienced show that a percentage of success varying from 67 to 88 has been attained.

The following is a brief *resumé* of the larger table, on pp. 2 and 3, and shows the percentage of success or failure in each district, the various stations in the district being named in Column 2 :—

SUMMARY OF RESULTS.

Districts.	Names of Stations.	Percentages.				Total percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N. - -	Golspie - - - -	47	34	11	8	81
„ E. - -	Longniddry, Glamis, Dunkeld, and Edinburgh (two observers).	44	31	16	9	75
ENGLAND, N.E. -	Morpeth, Darlington, Leyburn, and Ulceby.	51	30	11	8	81
„ E. -	Ipswich, Harpenden, and Romford.	47	23	20	10	70
MIDLAND COUNTIES -	Cirencester, Oxford, and Aylesbury.	65	18	13	4	83
ENGLAND, S. - -	Maidstone and Downton -	55	33	12	0	88
SCOTLAND, W. -	Islay, and Lochgilphead - -	44	23	14	19	67
ENGLAND, N.W. -	Bolton, Prescot, and Warrington	51	23	18	8	74
„ S.W. -	Clifton, Falfield, and Glastonbury	51	21	17	11	72
IRELAND, N. - -	Ballinrobe, and Oldcastle -	43	37	9	11	80
„ S. - -	New Ross - - -	27	32	26	15	59
	Mean for all districts -	48	28	15	9	76

It will be seen that for Great Britain the lowest percentage of success is attained in "Scotland, W." but it may be remarked that, of the two observers in this district, only one has sent in anything like a detailed return, and the values for the second station have therefore been estimated from the *opinions* of the recipient, as expressed by letter. It was, moreover, scarcely likely that the forecasts for such a region would prove very accurate.

"England, E." shows the next lowest percentage, but the values for this district have been considerably modified by the observations furnished from Rothamsted; the following remarks by the observer, Mr. Gilbert, on the *local* character of the weather in his neighbourhood are therefore produced in extenso :—"He (Mr. Lawes) added that he had long observed, and had done so more " particularly during the past summer, that the weather here frequently differed considerably from " that of a few miles distant. He cites two cases. On Thursday, July 3rd, he was at Woburn " Abbey with a party of foreigners, and I had here (at Rothamsted) large parties also. At Woburn " they had a comparatively good day, but here it is was inconveniently showery. On Friday, " July 4th, we had again a very large party here, and there were frequent heavy showers until " 3 or 4 p.m., while in London it was much finer. It is true that in neither of the above cases " was there *much* rain, but both were for agricultural purposes *wet* days." See Letter 2847, 79.

The very low percentage of "complete success" given for Edinburgh is due to the fact that the *winds* expected were on many occasions not experienced. Reference was therefore made to our working charts, but in nearly every case, the observations made by Mr. Buchan agreed with our own Leith reports, and, apparently with the wind experienced throughout the district of "Scotland, E." There can be no doubt therefore that, so far as wind is concerned, the forecasts for this region were bad.

The highest percentage of success is shown for "England, S.," both observers in this district reporting an entire absence of "total failures."

I am, &c.

The Secretary of the Meteorological Council. (Signed) FREDC. GASTER.

* In two instances, viz., Lymm (Warrington), and Edinburgh, the forecasts were continued for a longer period owing to the great interest taken by the gentlemen to whom the telegrams were addressed.

HAY HARVEST FORECASTS.

RETURN showing the NUMBER of FORECASTS sent to each of the under-mentioned PERSONS, with the SUCCESS or otherwise of the FORECASTS.

Districts.	To whom sent.	Address.	No. of Forecasts sent.	Percentages.				Opinion of Recipient as to Utility of Forecasts, expressed by Letter.
				Complete Successes.	Partial Successes.	Partial Failures.	Total Failures.	
0. SCOTLAND, N.	Rev. Dr. Joass	Golspie, N.B.	36	47·2	33·4	11·1	8·3	Observer formed a high opinion of the accuracy of the Forecasts. Letter 2551/79.
1. SCOTLAND, E.	W. S. Macdonald	Craigielaw, Longniddry	27	44·5	25·9	18·5	11·1	
	G. Johnston	Glamis, by Forfar	35	45·7	31·5	17·1	5·7	
	J. McGregor	Ladywell, Dunkeld	27	48·2	40·7	7·4	3·7	
	W. Allan	Gogar Station, Edinburgh	? 27	? 45·0	? 25·0	? 20·0	? 10·0	No regular report made, but Observer found that the Forecasts, while on the whole fairly correct, were, on five or six occasions, decidedly misleading. See Letter 2785/79.
	A. Buchan	Scottish Met. Soc., Edinburgh	45	35·6	31·1	20·0	13·3	
2. ENGLAND, N.E.	J. Wilson	Woodhorn Manor, Morpeth	30	43·4	30·0	23·3	3·3	
	W. Scarth	Raby Castle, Darlington	30	—	—	—	—	Return *very* incomplete. Observer says that he found the Forecasts very correct on the whole, but not so satisfactory towards the latter as during the early part of the time. Letter 2826/79.
	G. Wray	Leyburn, Yorkshire	27	51·9	29·6	7·4	11·1	
	J. Turner	The Grange, Ulceby	32	56·2	31·3	3·1	9·4	
3. ENGLAND, E.	R. C. Gripper	16, Coleman Street, Ipswich	24	59·1	13·6	22·7	4·6	Comparison seems to have been rather carelessly made.
	J. B. Lawes	Rothamsted, Harpenden	26	30·8	34·6	19·2	15·4	Forecasts not sufficiently local in character to be of much use to agriculturists. Letter 2847/79, and notes on p. 1.
	D. McIntosh	Havering Park, Romford	?25	? 50·0	? 20·0	? 20·0	? 10·0	No proper return made, but Observer says that, owing to the very unsettled state of the weather during the time he received the Forecasts, he cannot speak so favourably of them as he would wish. Letter 2566/79.
4. MIDLAND COUNTIES	Mr. Tanner	Cirencester	31	71·0	12·9	16·1	—	
	Major Dashwood	Kirtlington, Oxford	26	53·9	26·9	11·5	7·7	
	R. R. Fowler	Prebendal House, Aylesbury	?28	? 70·0	? 15·0	? 10·0	? 5·0	No regular comparison made, but Letter 2043/79, speaks very highly of the success of the Forecasts. Observer says, "they have only gone wrong on three or four occasions," and the information afforded him has greatly facilitated the management of his farm.

Districts.	To whom sent.	Address.	No. of Forecasts sent.	Percentages. Complete Successes.	Partial Successes.	Partial Failures.	Total Failures.	Opinion of Recipient as to Utility of Forecasts, expressed by Letter.
5. England, S.	C. Whitehead	Barming House, Maidstone	25	60·0	28·0	12·0	—	Observer is "much struck by the generally true "character of the Forecasts, especially with "regard to the weather." Letter 1850/79.
	E. P. Squarey	The Moot, Downton, Wilts	26	50·0	38·5	11·5	—	"Generally fairly in accord with the weather." Letter 2264/79.
6. Scotland, W.	J. S. R. Ballingal	Eallabus House, Bridgend, Islay	27	48·2	25·9	3·7	22·2	
	Sir J. W. P. Orde, Bart.	Auchnaba Ho, Lochgilphead	?27	?40·0	?20·0	?25·0	?15·0	Owing to illness of Lady Orde, Observer has been unable to make any proper comparison, but his impression is that the Forecasts were not very successful. Letter 2621/79.
7. England, N.W.	A. Ashworth	Egerton Hall, Bolton-le-Moors	38	65·8	13·2	13·2	7·8	"Remarkably correct about the wind, and fore-told a change in a most remarkable manner." Letter 2694/79.
	The Earl of Derby, per —— Harrison.	Knowsley Hall, Prescot	30	43·3	26·7	26·7	3·3	
	D. R. Davies	Agden Hall, Lymm, Warrington	65	44·6	29·2	12·3	13·9	"Singularly exact and correct on the whole." Letters 2388 and 2594/79.
8. England, S.W.	T. Dyke	Long Ashton, Clifton	?42	?60·0	?15·0	?15·0	?10·0	"About three-fourths of the Forecasts correctly described the weather." Letter 2659/79.
	J. Phillips	Whitfield, Falfield, R.S.O.	41	43·9	26·8	17·1	12·2	
	R. Neville	Butleigh Court, Glastonbury	?38	?50·0	?20·0	?20·0	?10·0	Return not sufficiently complete for proper comparison to be made. Observer says, "Forecasts were on the whole wonderfully "correct, but not certain enough to be of "much real use to farmers." Letter 2557/79.
9. Ireland, N.	J. Simson	Cloona Castle, Ballinrobe	34	29·4	47·1	8·8	14·7	
	Dr. Bentley	Oldcastle, co. Meath	30	56·7	26·7	10·0	6·6	
10. Ireland, S.	D. A. Millward	New Ross	34	26·5	32·3	26·5	14·7	"Forecasts not of much value." Letter 2060/79.
FORECASTS SENT BY POST.								
	W. P. Robinson	Trinity College, Glenalmond	28	50·0	28·6	14·3	7·1	
	R. H. Scott, Secretary	Forecasts sent during absence from Office.	28	53·6	28·6	10·7	7·1	

The above return has been drawn up somewhat roughly from the reports furnished by the various recipients.
Where " ? " appears in the column "No. of Forecasts sent," it indicates that the Observer has not himself stated the No. of Forecasts to which his figures apply.

Mr. Scott was instructed to place this report on the Minutes, and to forward copies to the Royal Agricultural Society and the several gentlemen who had received the Forecasts. He was also instructed to forward an abridged copy to the "Times" and other newspapers.

Read—A Memorandum from Captain Toynbee, reporting that since the last meeting seven logs had been received, three of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. T. M. Almond, F.R.A.S.	"Decapolis" -	Dec. 11, 1878—Jan. 18, 1880.	Brisbane and home -	1878, p. 65.
Capt. A. J. Brown -	Barque "Belleisle."	June 30, 1879—Jan. 16, 1880.	Jamaica and home -	1879, p. 7.
Capt. W. Barron -	SS. "Sultan" -	Sept. 12, 1879—Jan. 13, 1880.	Trading between Hull and Hamburg.	1879, p. 60.

Mr. Scott was instructed to convey the best thanks of the Council to the above-named observers.

Submitted—A reply (Letter 266) from Mr. Symons to Mr. Scott's letter, mentioned on the Minutes of the 24th ultimo, and further correspondence, (Letter 325) from the Chairman to Mr. Symons, and (Letter 319) the reply thereto. Mr. Scott was instructed to inquire, before proceeding further with the negotiations, how many stations with fairly continuous records of monthly values, for five years and upwards, are available.

Mr. Scott reported that he had applied to the London Institution for the erection of a Sunshine Recorder in Finsbury Circus, and that this negotiation was in progress. He had applied to the Royal Institution, in order to obtain a West End Station, and had received a favourable reply, but on examination had found that the roof of the building did not afford a sufficiently open exposure. He had therefore applied to the Royal Society.

The Chairman drew attention to the regulations existing for the supply of information to occasional applicants (Minutes 1876–7, p. 132), and stated that applications were becoming more numerous and interfered with the regular work of the staff.

It was resolved that the minimum charge for each inquiry should be 5*s.*; and that in the case of inquiries to which the principle of the Minute (1876–7, p. 132) is inapplicable, the Secretary should use his discretion.

The Chairman also stated that members of the staff were occasionally required to attend in courts of justice to give evidence as to the weather, and proposed that in future the charge made by the Office for each day's attendance should be 2*l.* 2*s.*, of which 10*s.* 6*d.* per day should be paid to the clerk giving evidence, and the remainder to the Office to cover the interruption of business.—Agreed to.

Read—Letter 310, announcing the death of Professor D. Thomson, which occurred on the 31st ultimo.—The Secretary was instructed to communicate with the Secretary to the University of Aberdeen in order to ensure the continuance of the records at the Observatory.

The Secretary reported that the "Instructions in the Use of Meteorological Instruments" was stated by the Stationery Office to be out of print, and that the type was still standing.

He was instructed to issue a reprint with verbal alterations.

STATEMENT of WORK done in PANTAGRAPH ROOM during January 1880.

January 31, 1880.

Ten Copper Plates have been engraved as follows: 1876, No. 38, completed; 1876, No. 39, completed except a few rain curves; 1879, Nos. 45–52, omitting wind and rain curves.

Zinc Plates.—Barograms 3 plates, Nos. 50–52, 1879; Thermograms 8 plates, Nos. 54–61, 1879; Anemograms and Rain Curves, none; Vapour Tension 4 plates, Nos. 49–52, 1879.

Photographic Curves have been ruled to Plate 54 for barograms, and Plate 61 for thermograms.

In addition, a new chart has been reduced and engraved for use on the Quarterly Weather Report plates, and careful measurements made of the copper plate from which the last supply of forms used in Beckley's rain-gauge was obtained. The result of the examination was the condemnation of the plate (which contained seven forms) as inaccurate.

I have been working principally with the Harmonic Analyser, and, in addition to several experimental curves, have passed the whole of the Kew temperature curves for 1870 through the instrument. Some time was also occupied in experiments with plates from Van Rysselberghe's meteorograph, and more recently in connexion with some errors shown in the Glasgow and Valentia thermograms.

The October tabulations were examined, and passed to the Computing Room on the 5th. The November sheets have not yet been received from Mr. Allen, the examination of the tabulations required for the Return of the Registrar General for Ireland having delayed their completion. Mr. Allen's report is attached.

R. H. Scott, Esq., F.R.S.

R. H. CURTIS.

STATEMENT of WORK done in EXAMINATION ROOM since 23rd December 1879.

January 23, 1880.

The following curves and tabulations have been examined :—

November.—Thermograms, all ; Barograms, three stations ; Anemograms, four stations.

December.—Such portion of the Valentia and Armagh work as was required for the Registrar General for Ireland.

The thermograms of Valentia and Glasgow have required considerably more than the ordinary time for their examination.

To R. H. Scott Esq., M.A., F.R.S.,
Secretary Meteorolgical Council.

T. E. ALLEN.

STATEMENT of WORK done in MARINE ROOM during January 1880.

Examined 16 new logs and 1 light-house register.

Cape of Good Hope District.

Winds.—Latitude and longitude lines drawn on copper plate proofs for four representative months, preparatory to production by lithography.

Barometer.—Means and range for single-degree squares obtained and charted for April and partially for October. Isobars drawn for January and July.

Air Temperature.—Means and range for single-degree squares obtained and charted for April and October and partially for February.

Isotherms drawn for April.

Currents.—Individual currents charted for August. Sea isotherms incorporated with currents for July, and proof charts received from lithographer. General current lines and areas of extreme range of sea temperature entered on proof for inspection of Council.

Sea Surface Temperature.—Means range for single-degree squares obtained and plotted for April and October and partially for February.

Isotherms drawn for January, April, and October.

Captain Hoffmeyer's endeavour to estimate weather in N. Atlantic by aid of land observations only, tested by comparison with actual weather experienced during four passages across the Atlantic in 1878.

R. H. Scott, Esq.

CHARLES HARDING.
February 1880.

HENRY TOYNBEE,
Marine Superintendent.

The following cheques for January were drawn on the 31st of that month :—

Administration :	£	s.	d.	£	s.	d.
A. J. Hodges, Council income tax	-		-	20	16	8
R. H. Scott, salary	-		-	66	13	4
J. S. Harding, jun.	27	15	6			
T. D. Bell — Salaries and wages	*18	6	7			
J. S. Harding, sen.	†11	4	7			
				57	6	8
Gas Light and Coke Co., gas	6	18	5			
,, ,, gas (No. 113)		2	9			
				7	1	2
Pall Mall Coal Co., coals	-		-	5	5	0
E. Higgs, office fittings, &c.	-		-	7	5	0
J. Weldon, books	-		-	1	11	0
Carried forward	-		-	£165	18	10

* Including increment and arrears.
† Five weeks to the 31st January.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	165	18	10
Special Researches:						
Chance Brothers, glass spheres - -	-		-	18	15	0
N. Hoffmeyer, charts - - - -	-		-	14	15	3
W. Lambrecht, hygrometer - - -	-		-	1	12	4
Negretti & Zambra, evaporators and repairs -	.		-	4	18	4
J. C. Walker, fixing sunshine recorder -	-		-	1	2	2
Land Meteorology:						
J. E. Cullum, salary - - - - -	-		-	15	16	8
R. H. Curtis -	22	4	5			
J. A. Curtis -	15	11	1			
T. E. Allen - } Discussion, &c. of Observations	15	11	1			
C. H. Thompson	†11	10	0			
E. G. Aldridge -	†9	3	4			
				73	19	11
Weather Information and Forecasts:						
F. Dangerfield, delivery of D. W. Charts -	-		-	12	3	2
J. J. Hicks, thermometer screens - -	-		-	3	10	0
W. Marriott, Weekly Meteorological Returns -	-		-	3	15	4
Postmaster General, Telegrams - -	-		-	172	9	1
Cliffony Postmaster, Sunday fees - -	-		-		17	0
Bundoran „ „ - -	-		-	1	1	0
Enniskillen „ „ - -	-		-		17	0
Stornoway „ „ - -	-		-	1	6	0
Wightman & Co., B. T. wrappers, &c. - -	18	0	6			
„ printing forecasts - -	24	16	3			
				42	16	9
Patent Type Founding Co., type - -	-		-	9	16	2
F. Gaster	30	7	6			
W. L. Dallas	19	15	1			
F. Brodie } Preparation and issue of Reports, &c.	*22	17	0			
G. G. Francis	*6	18	11			
H. W. Chivers	†8	5	0			
				88	3	6
Inspections:						
Rev. W. C. Ley, travelling expenses - -	-		-	19	3	1
Ocean Meteorology:						
Captain H. Toynbee	33	6	8			
R. Strachan -	27	15	6			
C. Harding - } Discussion, &c. of observations and care of instruments.	22	4	5			
H. Harries -	†14	0	0			
Lieut. C. W. Baillie	16	13	4			
				113	19	11
A. Canham -	-		-	1	19	2
A. M. Curtis -	-		-	5	12	11
S. E. Harding - } Copying observations for India Office.	-		-	2	1	7
M. James -	-		-	1	2	11
E. Rigby -	-		-	1	8	7
Negretti & Zambra, "A." instruments - -	37	0	9			
„ "B. T." „ - -	61	18	8			
				98	19	5
Nautical Magazine, advertisements - -	-		-	1	2	6
Pewtress & Co., printing „ - -	-		-	3	15	0
H. J. Thatcher, Cardiff agent - - -	-		-	3	1	7
P. A. Feathers, Dundee „ - - -	-		-	3	10	0
D. McGregor & Co., Glasgow agents - -	-		-	3	7	6
J. Gill, Liverpool agent - - -	-		-	11	14	0
A. G. Evans, Bermuda anemometer - -	-		-	4	12	0
Carried forward - -				£909	3	8

* Including increment and arrears. † Five weeks to the 31st January.

	£	s.	d.	£	s.	d.
Brought forward -	-		-	909	3	8
Miscellaneous :						
Pickford & Co., conveyance of parcels - -	-		-	6	2	1
W. Allingham, commissions - - -	-		-	6	0	7
C. Harding, ,, - - -	-		-	2	0	5
D. Currie & Co. ,, - - -	-		-	1	4	3
J. J. Hicks, ,, - - -	-		-	2	0	0
G. M. Whipple ,, - - -	-		-	19	17	6
Negretti & Zambra ,. - - -	-		-	70	10	4
J. S. Harding, jun., petty cash - -	100	0	0			
,, ,, - -	60	0	0			
				160	0	0
				£1,176	18	10

The Council then adjourned.

116, *Victoria Street, February* 21, 1880.

PRESENT :

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | PROFESSOR STOKES.
MR. GALTON. | GENERAL STRACHEY.
THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (February 7) were read and confirmed.

The Secretary reported, that pursuant to the instructions given at last meeting he had had on the 9th instant an interview with Sir R. Lingen, and had ascertained that the Treasury would refer to their Solicitor any matter about which the Council wished for legal advice.

He had accordingly, by the Chairman's directions, forwarded the following letter to the Treasury :—

P.C. 506.

Meteorological Office, February 19, 1880.

SIR,

SOME questions have been raised as to the precise legal position of the Meteorological Council, with reference to the arrangements which it is in contemplation to make with newspapers, for the publication of weather information and forecasts.

These questions did not appear of any great practical importance, so long as the Office was concerned with only two or three leading newspapers, but the Council felt that before they enter into any agreement with newspapers generally, the conditions under which they can properly do so ought to be definitely ascertained.

I am therefore instructed to ask you to request my Lords to obtain for the Meteorological Council such legal advice as may be necessary in this matter.

I enclose a copy of the correspondence which has already passed between the Council and the Treasury on this subject.

I have, &c.
(Signed) ROBERT H. SCOTT,
Secretary.

Resolved—That the Chairman confer with General Strachey, if occasion should arise for further communications with the Treasury before the next meeting of the Council.

Submitted—The following report on the Forecasts issued at 2h. 30m. p.m. and 8 p.m. for January :—

CHECKING of FORECASTS, January 1880.

The result of the checking of the forecasts for January 1880 (mainly the work of Mr. Dallas) is given in the accompanying table in which the letters used have the following significations :—

a = complete success.
b = partial (*i.e.* more than half) success.
c = Do. failure.
d = total failure.

The weather during the month was very tranquil, so that forecasting was comparatively easy, and it is hardly to be expected that so high a proportion of successful forecasts can be maintained under less favourable circumstances.

Afternoon (2.30 *p.m.*) *Forecasts.* In "Scotland N." "W." and "E." and "England N.E." and "S.W." the forecasts for "*weather*" were from 20 % to 30 % better than those for "*wind*;" in the E. and N.W. of England, as well as in Ireland generally, the proportion of successes was about equal,

while in the "Midland Counties" and "England S," the forecasts for "weather" were the more successful.

The highest percentage of success for *wind* was 96 °/₀ in "Ireland S."
„ lowest „ „ „ „ 77 °/₀ „ "Scotland W."
„ highest „ „ *weather* „ 97 °/₀ „ "England S.W."
„ lowest „ „ „ „ 80 °/₀ „ "England S."
The highest percentage of success for the whole forecasts 94 °/₀ „ "Ireland S."
„ lowest „ „ „ 81 °/₀ „ "England S" / "Scotland W."

while the average for all districts was 86 °/₀.

Evening, (8 p.m.) Forecasts. In all districts except "England E." and "S." and "Ireland S." the forecasts for *weather* were much more successful than those for *wind*. In "England E." and "S." the wind forecasts were slightly the better, while in "Ireland S." they were considerably so.

The highest percentage of success for *wind* was 92 °/₀ in "England E." / "England S."
„ lowest „ „ „ „ 73 °/₀ „ "Scotland W."
„ highest „ „ *weather* „ 92 °/₀ „ "Ireland N." / "England S."
„ lowest „ „ „ „ 84 °/₀ „ "England E." / "Midland Cos." / "England S." / "Scotland W."

while the average for all districts was 86 °/₀.

The highest percentage of success for the whole forecast was 90 °/₀ "Ireland S."
„ lowest „ „ „ „ 80 °/₀ "Scotland W."

"Scotland W." is represented in the Chart by Ardrossan only and the result is consequently very difficult to check.

2.30 P.M. FORECASTS.

DISTRICTS.		Per Centages of Success. Wind.	Weather.	Total.	Per Cent. Correct a + b.
SCOTLAND, N.	a	40 °/₀	66 °/₀	53 °/₀	86 °/₀
„	b	46	20	33	
„	c	7	7	7	
„	d	7	7	7	
SCOTLAND, E.	a	50 °/₀	67 °/₀	58 °/₀	88 °/₀
„	b	33	27	30	
„	c	17	3	10	
„	d	—	3	2	
ENGLAND, N.E.	a	43 °/₀	67 °/₀	55 °/₀	85 °/₀
„	b	37	23	30	
„	c	17	7	12	
„	d	3	3	3	
ENGLAND, E.	a	50°/₀	50 °/₀	50 °/₀	86 °/₀
„	b	30	43	36	
„	c	20	7	14	
„	d	—	—	—	
MIDLAND COS.	a	57 °/₀	50 °/₀	53 °/₀	83 °/₀
„	b	23	37	30	
„	c	13	10	12	
„	d	7	3	5	
ENGLAND, S.	a	53 °/₀	40 °/₀	46 °/₀	81 °/₀
„	b	30	40	35	
„	c	17	20	19	
„	d	—	—	—	
SCOTLAND, W.	a	50 °/₀	63 °/₀	56 °/₀	81 °/₀
„	b	27	23	25	
„	c	10	14	12	
„	d	13	—	7	
ENGLAND, N.W.	a	53 °/₀	50 °/₀	51 °/₀	85 °/₀
„	b	41	27	34	
„	c	3	20	12	
„	d	3	3	3	
ENGLAND, S.W.	a	47 °/₀	77 °/₀	62 °/₀	92 °/₀
„	b	40	20	30	
„	c	13	3	8	
„	d	—	—	—	
IRELAND, N.	a	63 °/₀	63 °/₀	63 °/₀	89 °/₀
„	b	20	33	26	
„	c	17	4	11	
„	d	—	—	—	
IRELAND, S.	a	63 °/₀	63°/₀	63 °/₀	94 °/₀
„	b	33	30	31	
„	c	4	7	6	
„	d	—	—	—	

8 P.M. FORECASTS.

DISTRICTS.		Per Centages of Success. Wind.	Weather.	On whole Forecast.	Per Cent. Correct a + b.
SCOTLAND, N.	a	42 °/₀	53 °/₀	48 °/₀	84 °/₀
„	b	38	35	36	
„	c	12	12	12	
„	d	8	—	4	
SCOTLAND, E.	a	50 °/₀	61 °/₀	55 °/₀	86 °/₀
„	b	35	27	31	
„	c	15	12	14	
„	d	—	—	—	
ENGLAND, N.E.	a	50 °/₀	62 °/₀	56 °/₀	88 °/₀
„	b	38	26	32	
„	c	8	4	6	
„	d	4	8	6	
ENGLAND, E.	a	77 °/₀	73 °/₀	75 °/₀	88 °/₀
„	b	15	11	13	
„	c	8	12	10	
„	d	—	4	2	
MIDLAND COS.	a	54 °/₀	61 °/₀	58 °/₀	82 °/₀
„	b	26	23	24	
„	c	8	12	10	
„	d	12	4	8	
ENGLAND, S.	a	65 °/₀	58 °/₀	62 °/₀	88 °/₀
„	b	27	26	26	
„	c	4	12	8	
„	d	4	4	4	
SCOTLAND, W.	a	31 °/₀	65 °/₀	48 °/₀	80 °/₀
„	b	42	19	32	
„	c	23	12	18	
„	d	4	4	4	
ENGLAND, N.W.	a	50 °/₀	61 °/₀	55 °/₀	84 °/₀
„	b	38	19	29	
„	c	8	12	10	
„	d	4	8	6	
ENGLAND, S.W.	a	31 °/₀	65 °/₀	48 °/₀	86 °/₀
„	b	54	23	38	
„	c	15	4	10	
„	d	—	8	4	
IRELAND, N.	a	54 °/₀	61 °/₀	58 °/₀	85 °/₀
„	b	23	31	27	
„	c	23	4	13	
„	d	—	4	2	
IRELAND, S.	a	69 °/₀	54 °/₀	62 °/₀	90 °/₀
„	b	19	38	28	
„	c	8	—	4	
„	d	4	8	6	

Submitted—The following report:—

CIRRUS CLOUD OBSERVATIONS.

SIR, February 21, 1880.

IN accordance with the instructions given in the Minutes, 1879, p. 38, I have communicated frequently with Mr. Ley, and have to report that Mr. Ley and I consider that the accompanying "Instructions on making and telegraphing to the Meteorological Office observations of cloud of the Cirrus type" are now in a fit state to be issued to the observers.

(Signed) FREDC. GASTER.

To the Secretary of the Meteorological Council.

INSTRUCTIONS on MAKING and TELEGRAPHING to the METEOROLOGICAL OFFICE OBSERVATIONS of CLOUDS of the CIRRUS TYPE.

IN telegraphing to the Meteorological Office information as to the appearance, quantity, and motion of cirrus clouds the following rules should be observed:—

1. Not more than one telegram should be sent on any one day, unless the alterations in the motion of the cirrus (either in direction or velocity) are of a very unusual character; but if thought desirable, more minute details than can be given in the 20 words of a telegram may be sent on a post card by next post.

2. The telegram should contain, as the *address* "*from*," merely the name of the observer and locality in which the observation is made; and in the address "*to*" the words "Met. Office, London."

3. In the body of the message insert—

Firstly, the hour of observation.

Secondly, the precise form of cloud seen, the observer using at his discretion the terms "feathery," "thin," "thready," "hair," "very lofty," &c. as required, and distinguishing carefully (as directed further on) between true *cirrus* and the highest forms of *cirro-cumulus*, of *cirro-stratus* (called hereafter "sheet-cirrus"), and *cirrus haze*. It is also desirable to say whether the cloud is (*a.*) in detached patches; (*b.*) in a mass (or bank); or (*c.*) spread tolerably uniformly over the sky.

Thirdly, the *amount* of cirrus, *not* its density.

Fourthly, the direction whence it is moving, and, as nearly as practicable, its rate of motion.

Fifthly, the point of the compass whence the clouds radiate (herein-after called the "r.-point.")

Sixthly, the bearing of the centre of the bank of cirrus, if there be a bank at all; and

Lastly, the direction and force of the surface wind, and the weather prevailing at the time of observations.

These details are to be transmitted by a telegraphic code to be explained further on.

There is no fixed hour for taking the observations, but it will be useless to transmit a message before 8 a.m. or later than 7 p.m.

CODE.

The observations of clouds of the cirrus type should be telegraphed to London by means of a code consisting of three groups, each group containing five figures. In preparing them the following scales will be used:—

SCALE A.

FORM OF CLOUD.

1 = True cirrus.
2 = Sheet cirrus.
3 = High cirro-cumulus.
4 = Cirrus haze.

SCALE B.

AMOUNT OF CLOUD.

0 = Very slight indeed.
1 = $\frac{1}{4}$ of sky covered.
2 = $\frac{1}{2}$ do. do.
3 = $\frac{3}{4}$ do. do.
4 = All do. do.
9 = Amount doubtful.

SCALE C.

TRUE BEARINGS, FOR DIRECTION OF MOTION OF THE CLOUDS, WIND, &c.

00 = Zero (Calm).
02 = N.N.E.
04 = N.E.
06 = E.N.E.
08 = East.
10 = E.S.E.
12 = S.E.
14 = S.S.E.
16 = South.
18 = S.S.W.
20 = S.W.
22 = W.S.W.
24 = West.
26 = W.N.W.
28 = N.W.
30 = N.N.W.
32 = North.
99 = Doubtful.

SCALE D.

VELOCITY OF MOTION OF CLOUDS OF THE CIRRUS TYPE.

0 = Motionless.
1 = Very slight motion.
2 = Moderate ,,
3 = Rapid ,,
9 = Doubtful.

SCALE E.

(Beaufort's Scale.)

FOR FORCE OF WIND.

Force.		
00.	Calm.	
01.	Light air -	Or, just sufficient to give steerage way.
02.	Light breeze -	Or, that in which a well-conditioned man-of-war, with all sail set, and clean full, would go in smooth water from - - - - 1 to 2 knots.
03.	Gentle breeze -	3 to 4 knots.
04.	Moderate breeze	5 to 6 knots.
05.	Fresh breeze -	Or, that to which she could just carry in chase, full and by - - - Royals, &c.
06.	Strong breeze -	Single-reefed topsails and topgallant sails.
07.	Moderate gale -	Double-reefed topsails, jib, &c.
08.	Fresh gale -	Triple reefed topsails, &c.
09.	Strong gale -	Close-reefed topsails and courses.
10.	Whole gale -	Or, that with which she could scarcely bear close-reefed main-top-sail and reefed foresail.
11.	Storm - -	Or, that which would reduce her to storm-stay-sails.
12.	Hurricane -	Or, that which no canvas could withstand.

SCALE F.

FOR DENSITY OF CIRRUS BANK, WHEN VISIBLE.

0 = Very thin and ill-defined.
1 = Thin, but definitely formed.
2 = Rather heavy.
3 = Heavy.
4 = Very heavy and angry.
9 = Doubtful.

SCALE G.

FOR WEATHER.

0 = Sky clear.
1 = ¼ covered with clouds of all kinds (*i.e.* upper and lower).
2 = ½ covered „ „
3 = ¾ „ „ „
4 = Entirely „ „ „
5 = Raining.
6 = Snow falling.
7 = Hazy.
8 = Foggy.
9 = Thunder.

The following are a few examples of messages, with explanations as to their meanings: —

EXAMPLE 1.

Two p.m.	1	1	28	2	26	22	0	20	06	7
	Form of cloud (see Scale A. above).	Amount of cloud (Scale B.).	Direction whence moving (Scale C.).	Velocity of motion (Scale D.).	Direction of "R.-point" (Scale C.).	Direction of centre of bank (Scale C.).	Density of bank (Scale F.).	Direction of wind at earth's surface (Scale C.).	Force of wind (Scale E.).	Weather at time of observation (Scale G.).

Meaning of above:—At 2 p.m. True cirrus covering about a quarter of the sky, moving with moderate velocity from N.W. The cloud radiating from W.N.W., and lying in a thin bank whose centre bears S.S.W. (true) from station. Wind at surface S.W. strong, weather hazy.

EXAMPLE 2.

Noon **39241** **99182** **18033**

Meaning of above:—Noon. Sheet cirrus, amount doubtful, moving very slowly from West. R.-point doubtful. Bearing of centre of bank doubtful, but portion visible, rather dense. Wind at time of observation S.S.W., gentle breeze; sky three fourths covered with lower forms of cloud.

EXAMPLE 3.

Noon **20000** **06000** **04010**

Meaning:—Very small quantity of high cirro-cumulus, motionless, radiating from E.N.E.; no bank. Wind at surface N.E., light airs; no lower cloud.

Instructions in Making Observations of the Upper Clouds.

The attention of the observer is especially to be directed to clouds of the "cirrus" type, inclusive of what are here defined as sheet-cirrus, high cirro-cumulus, and cirrus-haze; and it is to these types of clouds only that the following instructions refer.

Cirrus is the highest kind of cloud. When in moderate quantities it is commonly white, though when seen through haze it is usually somewhat cream coloured, and when the sun's rays have reached it through a long stratum of hazy atmosphere, is often of either an orange or rosy tint. In all cases it has a very delicate appearance. It is sometimes arranged like bunches of fine hair; and such tufts of cirrus are often called "mares-tails." At other times it resembles small curled feathers. Quite as commonly, however, it lies in thin light strands, like pale gossamer threads.

"High cirro-cumulus" differs from simple cirrus in consisting of small detached masses somewhat rounded in form, a great flotilla of which is often seen in the sky, especially in fine summer weather. Clouds at lower levels are frequently disposed in this manner, but the observer must be very careful to distinguish from these the high cirro-cumulus, which latter is either white, or changes its colour under the same circumstances as simple cirrus, no part of each cloudlet ever seeming to be decidedly *thrown into shadow* by another part. The high cirro-cumulus also possesses the same faintness and delicacy of outline which we observe in cirrus.

When cirrus overspreads a large portion of the sky it becomes what is here termed "sheet-cirrus." In this state, when not too thick, it produces "halos" or large rings round the sun and moon. The sheet-cirrus sometimes appears fibrous, sometimes reticulated; sometimes, however, it is only visible as either a milky or an oily-looking haze, or what is here termed "cirrus haze."

When the veil of this cloud becomes thick it assumes some neutral or muddy tint, except in those cases when it is so disposed that the rays of the rising or setting sun are reflected to us from its under surface, which then appears of either an orange or rosy colour.

I.

Amount.—Whenever on looking round the sky the observer notices clouds of the kinds above described, he should in the first place endeavour to ascertain their *amount*. In doing this he should observe whether they cover, first, only a trifling portion; secondly, about a quarter; thirdly, about a half; fourthly about three-quarters; or finally, the whole of the sky. The *extent*, not the density of the cloud, should be here attended to. If there be any considerable quantity of lower cloud in the sky, the amount of upper cloud cannot be accurately ascertained, and the figure "9" should be telegraphed as the figure for the amount.

II.

Direction of Movement.—The next thing to be attended to is the direction from which the upper clouds move, *i.e.* the direction of the air current in the higher regions of the atmosphere. Considerable difficulty will here be encountered. If some of these clouds happen to be nearly overhead, attention should at first be confined to such; and if possible the observer should so place himself as to have the projecting corner of a roof or chimney, the summit of a steeple, flag-staff, or other stationary object, very close to the line between his eye and the portion of cloud which he is about to watch.

A convenient plan* is to set up a pole reaching 5 feet $7\frac{1}{2}$ inches above the level of the observer's eye; a mark or ring should be placed round the pole at the latter level. The summit of the pole must carry two thin rods, fixed crosswise, and set truly to the four cardinal points. Through or near the extremities of these rods should pass a thin circular iron ring of 3 feet diameter, the use of which will be mentioned presently. The observer should, when opportunity offers, so station himself that some recognizable part of a cloud appears to move vertically either upwards from the top of the pole, or vertically downwards towards it. The direction of the pole from the observer's position, which may be judged of by the cross-rods, is then, in the first case, the direction of the upper current, in the second, its opposite. In watching the movements of the clouds, the observer may conveniently use a staff, one end of which is sharpened so as to stick in the ground, while the other is fitted with a crescent-shaped top in which to rest the arm, in order to support and steady the head.

If the clouds be observed from a window it is some assistance to have a few wires,—some horizontal, others vertical,—fastened across the window to the wall on the outside.

When, however, no part of the cloud is moving directly either towards or away from the observer, the effects of the perspective render it difficult to estimate the direction of movement exactly. To perfect oneself in the art, it is advisable as often as possible to endeavour to estimate the direction of movement of some portion of the cloud which is inconveniently placed, and then to find the actual direction of movement of another portion of the same cloud, or same sort of cloud which happens at the time to be conveniently placed. By patiently practising the eye in this process the observer eventually learns to make, automatically, tolerably exact allowance for the errors arising from perspective. In no case (should he have the least doubt as to the direction of movement) must any conjecture be telegraphed, but the figure for "motion doubtful" should be inserted in the telegram.

It is always well, when observing the movements of the upper clouds, either to rest the head against a wall or tree, or to support it on a staff, or by some other means, so as to be quite motionless while taking an observation.

* Other plans for effecting this object are under the consideration of the Council (p. 137).

III.

Apparent Velocity.—The next particular to be attended to is the *apparent velocity of motion* in he clouds, or the force of the current which carries them. The observer is requested to notice whether the cloud be actually *stationary*, move *slowly*, with *moderate rapidity*, or with *unusual rapidity*. Clouds of the cirrus types are seldom really motionless, but owing to their great distance they commonly, though not always, appear to move more slowly than the lower clouds, To estimate, even according to the very rough scale proposed, the apparent velocity of movements we have to encounter precisely the same difficulties which have presented themselves in finding the direction, and the training of the eye requisite for deciding this is identical. A cloud which is near the horizon of course presents much less movement to the eye than one which is near the zenith, because it is at a much greater distance ; and, further, the *apparent* movement of clouds which are travelling either across, or more or less obliquely to, the line of sight, is different from that of clouds which are travelling directly to or from the zenith. To test the accuracy of his estimate of the apparent velocity of clouds moving crossways and obliquely, the observer should, when occasion offers, compare it with his estimation of the apparent velocity of clouds in the same stratum passing overhead at the time. To test the accuracy of his latter estimation he will do well occasionally to notice how many seconds of time a recognisable portion of upper cloud takes in travelling 15 degrees on the sky, to or from the zenith. The pole arrangement already described can be employed for this purpose. In the last case a recognisable portion of cloud must be first caught in the zenith, the observer looking up the pole, applying his eye as closely as he can to the ring or mark above mentioned. He should then note the time, and again at the moment when the selected portion of cloud, as viewed from this spot, reaches the circular wire. The time taken by the clouds in passing over this distance from the zenith, which is (approximately) 15 degrees, should be then noted. When clouds of the cirrus types take a longer time than 600 seconds (or 10 minutes) in traversing 15 degrees to or from the zenith, their motion should be regarded as " very slow." When a less time than this, but a longer time than 300 seconds, or five minutes, as " moderate," and lastly whenever they take a less time than 60 seconds as " very rapid."

It may be mentioned that in simply looking at the sky without the aid of any appliance, inexperienced observers commonly estimate the position of the zenith wrongly because they do not throw the head far enough back.

IV.

" *R.-point.*"—Clouds of the cirrus kind very commonly lie in streaks, lines, or bands. Attention must next be given to the direction of these lines, *i.e.*, their *position* with respect to the points of the compass altogether *irrespective of the motion of the clouds.* When one of these bands happens to pass through the zenith, the point at which it reaches, or, if continued, would reach, the horizon, is to be noted. This point is called for convenience sake, the *R.-point*, or " point of radiation," because the cirrus bands while really parallel, appear in perspective to radiate from this point, or rather from one beyond it, and beneath the horizon. It is, however, comparatively seldom that a cirrus band happens to lie immediately over the observer's head ; the bands usually appearing in perspective as arches, or portions of arches, lying in any part of the sky, and variously inclined to the horizon, according to their distance from the observer. It is easy in these cases to find the R.-point, if we imagine ourselves able to travel over the earth's surface so as to get immediately under one of these bands. The best plan, however, is to note, first, the point on the horizon which lies beneath the summit of any visible complete arch of cirrus. If there be no complete arch, but only a short thread visible, the observer should extend his arm so as to point with the forefinger towards this thread, and then pass the arm briskly two or three times backwards and forwards from one part of the horizon to another, continuing as closely as he can the curve of the cirrus thread. The point on the horizon which is immediately beneath the highest part of the curve so formed should then be noted, and in every case the r.-point will be a point at right angles to this point on the horizon.

It is obvious that there must always be two r.-points opposite to each other. Although it is in itself immaterial upon which of these the observer fixes, he is requested as a matter of convenience, when he has already found a point from which the upper clouds *move*, to report the r.-point which is nearest to that direction, if one of the two be nearer than the other. For example, if cir. travels from W.N.W. and lies in strands which are disposed lengthwise N.W. and S.E., the r.-point N.W. should be reported in preference to the r.-point S.E.

The " selvedge " or margin of a sheet of cirrus gives the r.-point in the same way as a streak of detached cirrus. And when sheet-cirrus or cirrus haze completely covers the sky, a warp may frequently be seen in it which supplies the same datum.

Small cross rays or tangled threads may very often be noticed, frequently transverse or nearly so to the cirrus bands. These are especially discernible in some varieties of sheet-cirrus, when they form what we may call the " woof " of the cloud sheet, and give to the latter the reticulated appearance already mentioned. No notice of these threads is required in the telegrams. In rather common cases, however, the cross threads are so marked that it is impossible to decide whether a particular point of the compass, or one at about right angles to it, is rightly to be regarded as the r.-point. In such instances the observer should telegraph the number 99 for " Radiating point uncertain."

V.

Lastly, whenever a bank of sheet-cirrus appears on any horizon, or whenever being overhead, or nearly so, such a bank appears thicker in one part of the sky than in the other parts, the observer is

to report the position of the bank, *i.e.*, the direction in which the centre of the bank lies or in which it is thickest. This direction will not *necessarily* be at right angles to the r.-point, though it most commonly is so.

An effort must also be made to ascertain and report the density of the bank, in accordance with the figures given in Scale F.

Submitted also—The following memorandum, prepared by Mr. Gaster at the request of the Chairman :—

I am under the impression that the telegraphing of Cirrus observations would often be of great service. It is quite true that in numerous instances—perhaps in the majority of instances—the telegrams would *at first* be of little or no practical use, owing mainly to the imperfect state of our knowledge of the subject; but I venture to think that a sufficient number of really useful cases would occur to justify the starting of the system, at least as an experiment.

To be useful for the purpose of issuing forecasts or storm warnings, the observations must be telegraphed.

As to the cost, the maximum number of messages received in one day would be five, and of these three would cost nothing, because the observers would, in any case, be sending one of the regular telegrams (8 a.m., 0.45 p.m., or 6 p.m.). The remaining two telegrams (from Mr. Ley and Mr. Glyde) might (if desired) be sent only when in the opinion of the observers the appearance of the cirrus threatened the advent of bad weather; in other cases the observations might be sent by post-card, as done by Mr. Ley now. Thus it might be anticipated that 20*l.* would cover the entire cost of transmission for one year's experiment.

Resolved—That the proposed scheme of telegraphy of "cirrus" observations be carried out on the basis of the foregoing memorandum. Mr. Gaster to report on the result at the end of six months.

Resolved—That 5*l.* be placed at the disposal of General Strachey and Mr. Galton for preliminary trials with apparatus intended to facilitate observations of cloud motion.

Submitted—The discussion of the old sea temperature observations for the coasts of England and Ireland (Minutes, p. 50), and the schedules of observations on the new system for the two quarters ending 31st December 1879.

Mr. Galton submitted a wind and air temperature chart for the Cape district for January with wind-roses, generalized wind-arrows, air isotherms, and diagrams of barometric frequency and range. This chart was generally approved, and it was resolved that similar charts be prepared for the 12 months, and in the first instance for the other three cardinal months; this resolution to be in supersession of former arrangements, (Minutes, p. 98).

The Current and Sea Temperature Chart for July was also submitted, and it was agreed to have only one colour for the currents, instead of two as formerly proposed (Resolution iii., p. 98).

Resolved—That similar charts be prepared for the twelve months, and first for the other three cardinal months. The representation of the geographical features of South Africa to be omitted for the present, until a more satisfactory drawing is obtained.

Resolved—That the Marine Superintendent be instructed to pay special attention to the question of the routes to Australia in higher and lower parallels of latitude, so far as the district now under discussion is concerned, with the view of placing upon the chart any important results bearing upon this question that may be obtained.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting nine logs had been received, six of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last Mention on Minutes.
Capt. J. Buchan -	Barque "Commewyne."	Sept. 26 1879—Feb. 3 1880.	Glasgow to Surinam and home.	1879, p. 60.
Capt. J. F. L. P. Maclear, R.N., Sub-Lieut. J. H. East.	H.M.S. "Alert."	June 1—Oct. 2, 1879.	Surveying West Coast of South America.	1879, p. 78.
Capt. S. Morrish -	"Pendragon" -	Apr. 7, 1879—Feb. 7 1880.	To Java and home -	1877, p. 55.
Capt. C. W. Pearson	S.S. "Strathleven"	May 13, 1879—Feb. 2, 1880.	To Newfoundland and home. Sydney and home	1879, p. 7.
Capt. R. Peebles -	"Otago" - -	March 6, 1879—Feb. 5, 1880.	New Zealand - -	1878, p. 79.
Capt. W. Symington	S.S. "Hankow"	Sept. 20, 1879—Feb. 8, 1880.	Adelaide, Sydney, and home.	1879, p. 61.

Mr. Scott was instructed to present the Charts (O. 27) to Captain Maclear, and to convey the best thanks of the Council to the other Observers.

SUBMITTED—The following STATEMENT respecting the RECORDS for November 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :—	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Indifferent.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.
Action														
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0	0	0	0	0	0	*17 hrs.	*17 hrs.
Orientation verified	29th	—	24th	—	14th	—	7th	—	5th	—	29th	—	13th	—
No. of errors discovered by subsidiaries	0	0	0	0	0	1	0	0	1	0	0	0	0	1
„ „ irregular differences	0	0	0	0	0	0	1	8	0	0	0	0	3	4
Result of 40 *Remeasurements* :—														
Greatest difference	1·0	1·0	0·0	1·0	1·0	1·0	0·0	1·0	0·0	1·0	0·0	1·0	1·0	2·0
Mean difference irrespective of sign	0·1	0·4	0·0	0·3	0·0	0·4	0·0	0·5	0·0	0·4	0·0	0·4	0·0	0·7
Residual difference (—Meteorological Office)	−0·1	+0·1	0·0	−0·1	0·0	+0·1	0·0	−0·1	0·0	−0·2	0·0	+0·1	0·0	+0·1
RAIN GAUGE :—														
Action	Good.		Good.		Indifferent.		Indifferent.		Good.		Good.		Good.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		0		0		0	
Errors in tabulation	0		1		0		0		3		1		0	

BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Do.	Do.	Do.	Do.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	0
No. of errors discovered—							
In entry of standard	0	24	4	3	2	1	0
„ calculating residual correction	0	1	1	1	3	0	0
„ applying residual correction	1	1	0	5	3	1	0
„ subtraction in subsidiary tables	1	0	0	0	1	0	0
„ tabulation by subsidiaries	1	0	0	0	0	0	0
„ „ irregular differences	0	2	0	0	3	0	0
Result of 40 *Remeasurements :—*							
Greatest difference	0·005	0·008	0·006	0·009	0·009	0·005	0·005
Mean difference irrespective of sign	0·0019	0·0028	0·0022	0·0030	0·0026	0·0017	0·0020
Residual difference (—Meteorological Office)	+0·0001	—0·0014	—0·0001	0·0000	—0·0010	—0·0004	—0·0004
Mean monthly difference between simultaneous barograph and barometer readings	0·0018	0·0024	0·0012	0·0007	0·0024	0·0018	0·0015

THERMOGRAPH :—														
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.†	
Photography	Do.		Do.		Do.		Do.		Do.		Do.		Indifferent.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ failure of light	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ imperfectly moistened bulbs	—	—	—	0	—	14 hrs.	—	2 hrs.	—	3 hrs.	—	8 hrs	—	2 hrs.
„ „ partially frozen bulbs	—	12 hrs.	—	3 hrs.	—	3 hrs.	—	22 hrs.	—	61 hrs.	—	19 hrs.	—	0
„ „ other causes	0	0	0	0	0	0	0	0	‡6 hrs.	0	0	0	0	0
No. of errors discovered in entry of standard	0	0	1	0	0	0	1	1	0	0	0	0	0	0
„ „ by subsidiary measurements	0	0	0	0	0	0	0	0	0	0	0	0	0	0
„ „ of subtraction in do. tables	0	0	2	0	0	0	0	0	0	0	0	0	2	1
„ „ detected under glass scale	2	4	2	2	0	1	2	7	3	3	1	1	0	0
Result of 40 *Remeasurements :—*														
Greatest difference	0·3	0·3	0·2	0·3	0·4	0·3	0·3	0·3	0·3	0·3	0·2	0·2	0·7	0·7
Mean difference irrespective of sign	0·08	0·16	0·08	0·10	0·14	0·11	0·11	0·14	0·10	0·11	0·06	0·13	0·32	0·18
Residual difference (—Meteorological Office)	—0·06	—0·16	+0·02	+0·06	+0·12	—0·07	+0·06	—0·12	—0·01	+0·05	+0·04	+0·11	+0·32	+0·18
Mean monthly difference between simultaneous thermograph and thermometer readings	0·12	0·12	0·16	0·16	0·08	0·08	0·19	0·20	0·11	0·18	0·12	0·15	0·17	0·34
No. of errors in maxima and minima	0	—	3	—	0	—	4	—	3	—	1	—	0	—

* Part of loss due to cleaning instrument, and remainder to cylinder having been left unclamped. † The movement of instrument to change zero lines disarranged focus of wet trace, causing an error of nearly half a degree.
‡ Owing to low temperature, trace too low for the light.

The Secretary reported that the Board of Management of the London Institution had consented to receive a sunshine recorder (Minutes, Feb. 7). He was instructed to apply to Messrs. Thomas De La Rue & Co. to ascertain if they would be willing to take charge of a sunshine recorder in their premises in Bunhill Row, in case the Council should think it advisable to place a second in the City.

Professor Stokes submitted a specimen of a card coloured Prussian blue, and it was resolved that this colour be adopted. He also submitted the following draft of instructions to observers:—

DIRECTIONS FOR ADJUSTING AND USING THE SUNSHINE RECORDER.

The instrument when in position faces the south; the glass ball rests on the pedestal, and when the sun is shining casts an image which chars a slip of card previously placed in the instrument. As the sun travels from east to west, the place of the image gradually moves along the card, which is thus scored during sunshine, and left untouched when the sun is hid.

1. *Adjustment for Concentricity.*—It is possible that the instrument may require this adjustment. To see whether it does, put the ball into its cup, and see whether in the horizontal plane passing through the ball's centre the surface of the glass stands at the same distance all round from the middle points of the belts on which the cards are destined to lie. If not, the pillar supporting the ball may be adjusted by loosening the screw underneath which fixes it, moving the pillar in the required direction, and when it is right, turning the screw home.

If the adjustment is not within range of the hole in the slate, which for this object was designedly made a little large, the hole may be enlarged a little in the required direction by filing. Unless you are confident of being able to effect the adjustment thus, you had best not attempt the filing, but write to the Office.

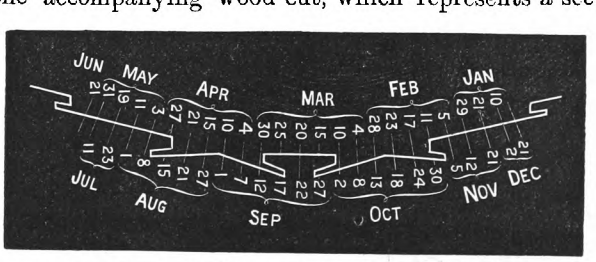
2. *Choice of Position.*—It is almost needless to remark that a position should be chosen where a clear view of the sky, or at least of such portions of it as the sun is liable to occupy, is as little as may interfered with by buildings, trees, &c. The instrument itself, when roughly in position, will show what portions the sun is liable to occupy.

3. *Adjustment for Level.*—The instrument is to be placed level as regards east and west, though at most stations, as will be mentioned presently, it requires to be tilted a little in the plane of the meridian.—The plane of the top of the instrument, that is, the plane of section of the bowl, may perhaps not be quite parallel to the upper surface of the slate base, and in adjusting for level it is well not to trust to the surface of the slate, but to use the plane of the top of the bowl.

4. *Adjustment for Latitude.*—In most of the instruments which have been made for the United Kingdom, the brackets supporting the bowl have been made to a common pattern, suited to a mean latitude of about 53°. Except for stations very nearly in that latitude, the stand will require to be tilted a little in the plane of the meridian, through an angle equal to the difference between 53° and the latitude of the place. At stations north of 53°, the northern edge of the stand will require to be raised, at stations south of 53° the southern. For the moderate differences of latitude with which we are concerned, the elevation of edge required may be taken nearly enough at one-eighth of an inch for each degree of difference between the latitude and 53°.

In some few of the instruments the brackets have been made to suit a different latitude. In such cases the above rule will apply on substituting that latitude for 53°.

The above rule will suffice for making the adjustment for latitude very nearly right. To test and if need be correct it, the height of the image of the sun should be noted on some day when the sun is shining within an hour or so of noon, and compared with the proper height for that day. This may be obtained from the accompanying wood-cut, which represents a section of the inner surface



of the bowl by a plane passing through the polar axis of the ball. The figure is graduated for every 2° of the sun's declination, as well as for the maximum declination; and the days in the spring and autumn halves of the year at which the sun has most nearly any one of these declinations are written on the woodcut. Should the day on which it is wished to test the adjustment be some intermediate day, the proper place of the image may be obtained by estimation, remembering that the declination changes very slowly about each solstice.

5. *Adjustment for the Meridian.*—This adjustment is best made by means of the time, and as fairly correct time can now nearly everywhere be obtained, it seems needless to give methods of adjustment in which the time is supposed unknown.

Supposing then the instrument placed roughly in the plane of the meridian, it may be adjusted, provided the sun is shining about noon, by turning it a little, if necessary, in Azimuth, so as to make the image of the sun cast by the ball fall on the meridian mark in the instrument at the moment of *apparent local* noon.

We are not restricted to noon for the adjustment. Any other hour may be taken, supposing the card to have been properly inserted, by taking advantage of the hour lines marked on the card. At the moment when any hour is reached according to apparent local time, the instrument is to be turned so as to cause the image of the sun to fall on the corresponding hour line. Should it be cloudy at noon, it would be well to choose for the adjustment an hour not very far from noon, as in that way defects in the other adjustments would have less effect on the adjustment for the meridian.

This supposes the correct time to be at least fairly well known. The time got from a railway clock will probably be at Greenwich or Dublin, &c. time, and to get the local mean time we must first add or subtract a time proportional to the difference of longitude between the station of observation and the place the time of which is given by the clock, at the rate of 4 minutes per degree, adding or subtracting according as the station of observation lies east or west of the place for which the time is given by the clock. Having thus got the local mean time, the local apparent time will be obtained by adding or subtracting the equation of time, as given in the accompanying table.

TABLE giving for every THIRD DAY in LEAP YEAR the EQUATION of TIME to the NEAREST HALF MINUTE, to be ADDED TO or SUBTRACTED FROM LOCAL MEAN TIME, according as the Sign is + or −, in order to get Local Apparent Time.

Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	− 3½	−14	−12½	−4	+3	+2½	−3½	−6	+ ½	+10½	+16½	+10½
4	− 5	−14	−12	−3	+3½	+2	−4	−6	+ 1½	+11½	+16½	+ 9½
7	− 6½	−14½	−11	−2	+3½	+1½	−4½	−5½	+ 2½	+12½	+16	+ 8
10	− 7½	−14½	−10½	−1	+4	+1	−5	−5	+ 3½	+13	+16	+ 7
13	− 9	−14½	− 9½	− ½	+4	0	−5½	−4½	+ 4½	+14	+15½	+ 5½
16	−10	−14½	− 8½	+ ½	+4	− ½	−6	−4	+ 5½	+14½	+15	+ 4
19	−11	−14	− 8	+1	+3½	−1	−6	−3½	+ 6½	+15	+14½	+ 2½
22	−11½	−14	− 7	+1½	+3½	−2	−6	−2½	+ 7½	+15½	+13½	+ 1
25	−12½	−13½	− 6	+2	+3½	−2½	−6	−2	+ 8½	+16	+12½	− ½
28	−13	−13	− 5	+2½	+3	−3	−6	−1	+ 9½	+16	+11½	− 2
31	−13½	−12	− 4	+3	+2½	−3½	−6	0	+10½	+16½	+10½	− 3½

6. *Confirmation of Adjustments.*—In order that each of the adjustments mentioned above should be sufficiently exact the other adjustments would have to be nearly right. Hence, when the adjustments are deemed to be right, they should be tested, which may be easily done when the sun shines, even though not quite continuously.

The adjustment for the meridian and the adjustment for level east and west are tested together by seeing whether at *apparent local* noon (or at 11 a.m., 1 p.m., &c.) the image falls on the noon hour line (or on the 11 a.m., 1 p.m., &c., hour line), and whether the line scored by the sun on a card runs parallel to the nearest edge of a flange confining the card. Theoretically, it should not be *quite* parallel, on account of the change of declination of the sun during the day; but even near the equinoxes this is too small to come under notice.

If reasonable care has been taken in levelling the top of the bowl in an east and west direction, no material error of level is to be feared; and a defect of parallelism of the score to the flange, though such as might be produced by an error of level, should lead the observer rather to question and to re-examine the adjustment for the meridian. It may be that when the adjustment was made incorrect time was used, or the correction for the equation of time was forgotten, or applied with a wrong sign.

The adjustment for latitude is tested by seeing whether the image of the sun falls at the proper height on the card corresponding to the day of the year.

Once well adjusted, the instrument need not be disturbed, and it may be fixed in its place by cement or otherwise. It is possible, however, that at some stations, from the positions of buildings, &c., one place might be best for the instrument in summer, and another in winter. In such cases there is no objection to making the change. Of course the instrument will have to be re-adjusted after each change of position.

For the sake of those who wish to make use of the mathematical expressions for the errors of time and parallelism produced by given small errors of level and azimuth, the expressions are here subjoined.

Let l be the latitude, δ the sun's declination, both reckoned positive when north, α the small error of azimuth, λ that of level east and west, h the error of hour angle entailed, p the error of parallelism, α, λ, h, p being respectively reckoned positive when in the direction of the hands of a watch to an observer looking vertically downwards for the first, horizontally northwards for the second, downwards in the direction of the earth's axis for the third, downwards in the direction of the sun's rays at apparent noon for the fourth; then—

$$h = \left\{ \alpha \sin (l - \delta) - \lambda \cos (l - \delta) \right\} \sec \delta,$$

$$p = (\alpha \cos l + \lambda \sin l) \sec \delta,$$

and

$$\alpha = p \cos (l - \delta) + h \sin l,$$

$$\lambda = p \sin (l - \delta) - h \cos l.$$

7. *Choice and Insertion of the Cards.*—Cards are provided of three patterns, rectangular for the equinoxes, and curved for summer and winter. The summer and winter cards are alike except as to length (the summer cards being the longer), and as to having the hour figures printed so as to be seen erect when in the one case the convex and in the other the concave edge of the card is held uppermost.

It will be noticed that the bowl is undercut inside so as to leave six grooves roofed in by flanges which are destined to confine the edges of the cards. The grooves or their flanges will here be numbered from the top downwards. The winter cards are inserted, concave upwards, with their edges under flanges Nos. 1, 3, and slid along till the noon hour line is against the line marked on the brass. Should the two marks on the brass not exactly agree, that nearest to the equator of the instrument had best be used. Nothing more is required in general till next day, when the card is pulled out and a fresh one put in. In time of snow, however, when there is any chance of sunshine, the snow should be removed from between the ball and the card.

If the sun should be shining when a fresh card is being put in, the observer should stand on the south side of the instrument. or otherwise shade the ball, lest a false score should be made on the card before it gets into the proper position.

The equinoctial cards are similarly inserted, with the hour figures erect, under flanges Nos. 2, 5, and the summer cards, convex uppermost, under flanges Nos. 4, 6.

The equinoctial cards are to be used during March and the first 12 days of April, and again during September and the first 12 days of October; the summer or winter cards, as the case may be, are to be used during the remainder of the year.

8. *Shortening of the Equinoctial Cards.*—If the ends of the equinoctial cards were left projecting above the brass frame, they would intercept the sun's rays near sunrise and sunset. The parts projecting above the horizontal top of the frame should therefore be cut off. If the observer chooses, he may cut off the ends before inserting the cards, by cutting one in the instrument, and using it as a pattern by which to cut the others. It would be unnecessary to remove the ends of the summer and winter cards, as they are not in the way.

These instructions were adopted, and it was resolved that they should hereafter be accompanied with a description of the instrument, illustrated by woodcuts, and should be printed as an appendix to the Annual Report.

The Secretary reported with reference to the supply of an anemometer to Sombrero (Minutes, p. 50), that after correspondence with the Board of Trade, he had obtained from Mr. Munro an estimate for a suitable anemometer at a cost of 28*l.* 15*s.* (Letter 517), and it was resolved that this instrument be ordered.

Mr. Galton submitted a proposal for a form of anemometer, bridled by torsion, suitable for lighthouses and other similar situations.

Resolved—That 10*l.* be placed at his disposal for preliminary experiments on this instrument.

Submitted—Letters 3043, 1879, and 131, 1880, from Captain Watson, enclosing results of comparative experiments with various anemometers made on board the R.M.S. "Algeria." Mr. Scott was instructed to write, conveying the thanks of the Council to Captain Watson.

Submitted—The following report on the performance of Hagemann's anemometer (Minutes, p. 73).

Kew Observatory, Richmond, Surrey,
February 20, 1880.

DEAR MR. SCOTT,

I HAVE much pleasure in reporting that the Hagemann's anemometer proved, on adoption of your suggestion as to the dropping of shot down the tube, to be a most convenient handy instrument for determining wind force, and we were able during yesterday's brisk wind to make a series of 76 comparisons between its indications and those of our free-running standard Robinson anemometer.

The enclosed memorandum of the results proves that the graduations on the instrument give wind velocities considerably below the Robinson.

During the experiments the rate of the wind varied between 17·2 and 7·6 metres per second, and the Hagemann's followed the fluctuations in velocity pretty closely.

The question of graduation of the scale is, however, an important one, and I fear we can never hope to observe winds of sufficient force at this observatory to give materials for determining the true scale by comparison.

I have, &c.
G. M. WHIPPLE.

R. H. Scott, Esq., F.R.S.

COMPARISON of HAGEMANN'S ANEMOMETER with the KEW DIAL ANEMOMETER, February 19, 1880.

Experiments made with two Pellets of Shot placed in the Tube of Hagemann's Instrument.	Hagemann. Metres per Second.	Kew. Metres per Second.	Ratio. Hagemann. / Kew.
			%
1. Twelve readings were observed at intervals of 30 seconds of both instruments, the mean result being - - -	7·3	11·8	62
2. Ten readings at an interval of 30 seconds gave a mean -	8·0	12·6	63
3. Sixteen readings were next taken at every 15 seconds, the mean equalling - - - - - - -	6·9	11·1	63
The following observations were then made with one pellet of shot only in Hagemann's instrument:—			
1. Twenty readings were noted at intervals of 15 seconds, and the mean result found to equal - - - -	7·6	11·3	67
2. Eighteen readings were next observed at intervals of 10 seconds, the mean being - - - - -	8·2	13·5	61
Mean of the whole - - -	7·6	12·1	63

The Secretary was instructed to send a copy of this Report with the original data on which it is founded to Captain Hoffmeyer and Captain Watson.

With reference to the correspondence with Mr. Symons relative to the publication by the Office of rainfall values from data to be supplied by him, Mr. Scott submitted his letter to Mr. Symons (Letter 472), and Mr. Symons' reply thereto (Letter 488), in which he asked for further particulars before stating his terms for supplying the information asked for.

Mr. Scott further submitted a report (Letter 526) on the number of stations for which monthly returns for long periods have been printed in the Reports of the British Association.

The Chairman was requested to state in reply to Mr. Symons, that the Council think it important to obtain monthly values, and not merely monthly means; and, while calling the attention of Mr. Symons to the great number of monthly values already published in the Reports of the British Association, to inquire whether, and if so, on what terms, he would be willing to supply a complete series of monthly values from the records in his possession (Letter 652).

Submitted—Contributions to our knowledge of the Meteorology of the Arctic Regions, Part II. (Minutes, 1877, p. 78).

Mr. De La Rue called attention to the desirability of instituting observations with very sensitive barometers, at short intervals during an auroral discharge, with the view of discovering whether any rapid oscillations accompany the changes in the aspect of the phenomenon. Theoretical considerations and the results of some experiments had led him to expect that such would be the case.

The Secretary reported, with reference to the recent Arctic Conference at Hamburg (Minutes, p. 123), that, inasmuch as the members of that Conference had constituted themselves into a permanent committee for the organization of the proposed scheme for concerted circumpolar observations in 1881-82, as explained in the Report of the meeting, the International Meteorological Committee had intimated to the President of the New Arctic Committee that it did not propose to take any action in connexion with the subject (Letter 435).

He also reported that he had learnt that the Governments of Denmark and Norway had voted funds for the stations they proposed to establish in Greenland and Finmark respectively, and that Lieutenant Weyprecht had announced that funds were available for his proposed station in Nova Zembla, while Professor Buys Ballot had ordered instruments through the Meteorological Office, for a proposed Dutch Station, the locality of which had not been formally announced; and, finally, that the German Admiralty had ordered one of its ships to visit the South Georgian Islands (in lat. 54° 30′ S. long. 37° W.), and report on the possibility of establishing a station there.

The Secretary reported that he had received a letter from the Secretary to the Senatus of Aberdeen University (Letter 458) stating that the observatory would be maintained pending the appointment of a successor to Professor Thomson.

The Council then adjourned.

116, *Victoria Street*, *March* 6, 1880.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE. | PROFESSOR STOKES.
MR. GALTON. | GENERAL STRACHEY.
THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of the last meeting (February 21) were read and confirmed.

Read—Letter 584, from the Admiralty, stating that the necessary orders would be issued for the proposed synchronous observations at 0h. 43m., Greenwich Mean Time (Minutes, p. 124).

The Hydrographer reported that he had received a telegram from General Myer on the 1st instant (Letter 648), stating that the Chief Signal Office proposed to change the time of observation to 0h. 8m. Greenwich Mean Time, and that, after consultation with the Secretary, he had replied by telegraph that he would consult the Council as to their acceptance of the proposed change.

The Secretary reported that he had at once communicated with M. Mascart in Paris, and Professor Wild at St. Petersburg, and had been informed by them that no intimation of the proposed change of hour had been made to either of them.

The Secretary was instructed to inform General Myer by telegraph that the Council was not prepared at present to accept the proposed change of hour, and to prepare for the Chairman's approval a reply, stating that the Council hesitated to make the change until General Myer could assure them that other nations had consented.

All further action to be suspended until a reply is received from General Myer.

The Secretary reported, with reference to the resolution adopted by the Congress at Rome, recommending an international comparison of standard instruments at the principal observatories of Europe, that he had recently received the subjoined circular (Letter 289) from M. Wild, the President of that Committee:—

1°. Approuvez-vous en principe la proposition de faire faire des-à-présent par les soins du Comité la comparaison des instruments normaux des Instituts centraux?

2°. En cas d'affirmation approuvez-vous le mode d'exécution proposé par M. Wild dans son rapport mentionné (partie IV.)?

3°. Si vous acceptez ces propositions. Votre institut central de météorologie pense-t-il prendre part à cette entreprise en payant sur la première demande du bureau du Comité la quote relative d'environ 360 frs.?

4°. Êtes-vous de l'avis qu'il faut en même temps commencer la comparaison des anémomètres normaux des différents instituts centraux en faisant circuler un anémomètre normal?

Resolved—That M. Wild be informed that the Council will be very glad to assist in the proposed plan, and will contribute 360 francs for the purpose, but that they refrain from expressing any opinion as to the degree of accuracy which can be obtained in a comparison carried out in the manner suggested (Letter 679).

Read—A letter from the Kew Committee (2689/79), proposing that the Council should purchase a battery of 1,000 cells to determine the scale of the electrograph, also a further letter (2867/79), proposing that an absolute electrometer be procured for the purpose.

Mr. De La Rue reported (Letter 658) that the cost of a battery of 1,080 chloride of silver cells would be about 74*l.* for the battery, and 6*l.* 5*s.* for the cabinet to contain it, in all 80*l.* 5*s.*, the intrinsic value of the silver being 30*l.*

Resolved—That the question of the discussion of the electrograms (Minutes, 1878, p. 37), be postponed until next meeting, and that Mr. Whipple be requested to replot a few of the electrograms on an equidistant scale.

Mr. Galton submitted a current and sea temperature chart, with the regions of greatest variation of temperature shown by stippling.—The method was approved.

It was agreed (1.) That the generalized wind and current arrows should not be drawn until the MS. wind and current charts are completed in other respects.

(2.) That the question (Minutes, p. 138) relating to the routes to Australia, in higher and lower parallels of latitude, be taken up when the MS. wind and current charts are completed.

(3.) That no charts be lithographed, unless initialed by authority of the Chairman.

Captain Toynbee submitted the temperature Chart of the Pacific for May, prepared by Lieutenant Baillie (Minutes, p. 99).—Approved.

The paper "Contributions to Arctic Meteorology, Part II.," submitted at last meeting, was approved for press.

The Secretary was instructed to direct Mr. Strachan to prepare a memorandum as to the probable extent of Part III.

Submitted—The following report on the Forecasts for February (Minutes, p. 31) :—

The letters used have the following signification :—

a complete success.
b partial (*i.e.*, more than half) success.
c partial failure.
d total failure.

2.30 P.M.

Districts.		Percentages. Wind.	Weather.	Entire Forecast.	Percentage of Success a + b.
Scotland, N.	a	34	69	52	76
"	b	34	14	24	
"	c	18	14	16	
"	d	14	3	8	
Scotland, E.	a	24	34	29	71
"	b	38	45	42	
"	c	28	14	21	
"	d	10	7	8	
England, N.E.	a	31	60	46	81
"	b	45	24	35	
"	c	17	14	16	
"	d	7	—	3	
England, E.	a	62	69	66	90
"	b	28	21	24	
"	c	3	7	5	
"	d	7	3	5	
Midland Cos.	a	31	55	43	85
"	b	52	31	42	
"	c	3	7	5	
"	d	14	7	10	
England, S.	a	35	51	43	88
"	b	48	41	45	
"	c	7	8	7	
"	d	10	—	5	
Scotland, W.	a	7	59	33	69
"	b	48	24	36	
"	c	21	10	16	
"	d	24	7	15	
England, N.W.	a	34	34	34	68
"	b	28	40	34	
"	c	24	13	19	
"	d	14	13	13	
England, S.W.	a	21	51	36	74
"	b	41	35	38	
"	c	24	11	18	
"	d	14	3	8	
Ireland, N.	a	10	59	35	66
"	b	38	24	31	
"	c	31	10	20	
"	d	21	7	14	
Ireland, S.	a	17	69	43	68
"	b	28	21	25	
"	c	27	10	18	
"	d	28	—	14	

8 P.M.

Districts.		Percentages. Wind.	Weather.	Entire Forecast.	Percentage of Success a + b.
Scotland, N.	a	44	64	54	76
"	b	20	24	22	
"	c	12	8	10	
"	d	24	4	14	
Scotland, E.	a	32	40	36	72
"	b	36	36	36	
"	c	8	16	12	
"	d	24	8	16	
England, N.E.	a	24	28	26	84
"	b	60	56	58	
"	c	8	16	12	
"	d	8	—	4	
England, E.	a	68	68	68	86
"	b	20	16	18	
"	c	8	16	12	
"	d	4	—	2	
Midland Cos.	a	36	44	40	76
"	b	40	32	36	
"	c	20	20	20	
"	d	4	4	4	
England, S.	a	56	44	50	84
"	b	32	36	34	
"	c	4	20	12	
"	d	8	—	4	
Scotland, W.	a	32	48	40	64
"	b	32	16	24	
"	c	8	16	12	
"	d	28	20	24	
England, N.W.	a	20	32	26	64
"	b	40	36	38	
"	c	28	24	26	
"	d	12	8	10	
England, S.W.	a	32	64	48	74
"	b	32	20	26	
"	c	24	12	18	
"	d	12	4	8	
Ireland, N.	a	24	60	42	78
"	b	40	32	36	
"	c	20	4	12	
"	d	16	4	10	
Ireland, S.	a	24	60	42	64
"	b	28	16	22	
"	c	24	20	22	
"	d	24	4	14	

SUBMITTED—The following STATEMENT respecting the RECORDS for December 1879, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :— Action	Direction. Good.	Velocity. Good.	Direction. Indifferent.	Velocity. Indifferent.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Indifferent.	Direction. Good.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.	Direction. Indifferent.	Velocity. Good.
Records deficient, due to stoppage of clock	0	0	0	0	7 hrs.	7 hrs.	0	0	0	0	0	0	0	0
„ „ other causes	0	0	0	0	0	0	*10 hrs.	*10 hrs.	0	0	0	0	0	0
Orientation verified	20th	—	31st	—	15th	—	20th	—	6th	—	24th	—	4th	—
No. of errors discovered by subsidiaries	0	0	0	1	0	0	0	0	0	0	0	0	0	0
„ „ irregular differences	0	0	0	0	0	0	1	7	2	2	0	0	0	5
Result of 40 *Remeasurements* :—														
Greatest difference	0·0	1·0	0·0	1·0	1·0	1·0	1·0	1·0	0·0	1·0	0·0	1·0	1·0	3·0
Mean difference irrespective of sign	0·0	0·3	0·0	0·5	0·1	0·6	0·1	0·4	0·0	0·4	0·0	0·3	0·0	0·7
Residual difference (— Meteorological Office)	0·0	−0·1	0·0	−0·1	−0·1	−0·1	0·0	+0·2	0·0	+0·1	0·0	+0·1	0·0	+0·1

RAIN GAUGE :— Action	Good.		Good.		Indifferent.		Indifferent.		Good.		Good.		Good.	
Records deficient, due to stoppage of clock	0		0		0		0		0		0		0	
„ „ other causes	0		0		0		0		0		0		0	
Errors in tabulation	0		0		0		0		2		3		0	

BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good	Good.
Photography	Do.	Indifferent.	Do.	Do.	Do.	Do.	Do.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
,, ,, failure of light	0	0	0	0	0	0	0
,, ,, other causes	0	0	0	0	†1 hr.	0	0
No. of errors discovered—							
In entry of standard	0	3	0	3	1	0	0
,, calculating residual correction	0	1	2	0	3	0	0
,, applying residual correction	0	0	0	3	2	2	2
,, subtraction in subsidiary tables	0	0	0	2	0	4	0
,, tabulation by subsidiaries	0	0	0	0	0	0	0
,, ,, irregular differences	1	10	2	1	0	1	0
Result of 40 *Remeasurements* :—							
Greatest difference	0·005	0·008	0·005	0·005	0·006	0·005	0·005
Mean difference irrespective of sign	0·0022	0·0028	0·0024	0·0018	0·0026	0·0020	0·0017
Residual difference (— Meteorological Office)	−0·0002	+0·0011	+0·0001	+0·0003	+0·0011	+0·0011	+0·0005
Mean monthly difference between simultaneous barograph and barometer readings	0·0019	0·0028	0·0012	0·0008	0·0028	0·0018	0·0018

THERMOGRAPH :—																
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Indifferent.		Do.		Do.		Indifferent.		Do.		Do.			
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.		
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
,, ,, failure of light	‡1 hr.	‡1 hr.	0	0	0	0	0	0	0	0	0	0	0	0		
,, ,, imperfectly moistened bulbs	—	0	—	0	—	36 hrs.	—	1 hr.	—	1 hr.	—	3 hrs.	—	4 hrs.		
,, ,, partially frozen bulbs	—	44 hrs.	—	18 hrs.	—	10 hrs.	—	23 hrs.	—	84 hrs.	—	8 hrs.	—	7 hrs.		
,, ,, other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
No. of errors discovered in entry of standard	0	0	1	3	0	0	1	0	0	3	0	0	0	0		
,, ,, by subsidiary measurements	0	0	0	0	0	0	0	1	0	0	0	0	0	0		
,, ,, of subtraction in do. tables	0	0	2	0	0	0	0	4	1	3	0	0	1	1		
,, ,, detected under glass scale	2	0	6	7	0	0	2	6	5	4	0	2	§	12		
Result of 40 *Remeasurements* :—																
Greatest difference	0·3	0·2	0·4	0·3	0·2	0·2	0·2	0·3	0·3	0·4	0·2	0·3	0·6	0·3		
Mean difference irrespective of sign	0·11	0·10	0·11	0·11	0·09	0·09	0·06	0·11	0·12	0·10	0·05	0·11	0·34	0·12		
Residual difference (— Meteorological Office)	−0·10	+0·08	+0·01	+0·05	−0·03	−0·05	+0·04	−0·07	+0·01	−0·02	0·00	+0·01	+0·33	+0·10		
Mean monthly difference between simultaneous thermograph and thermometer readings	0·12	0·16	0·19	0·18	0·09	0·08	0·19	0·14	0·20	0·25	0·12	0·12	0·17	0·32		
No. of errors in maxima and minima	1	—	7	—	1	—	5	—	3	—	0	—	10	—		

• Pencils not lowered. † Cylinder moved. ‡ Water in gaspipe. § The month's curves retabulated at Meteorological Office, owing to faulty tabulation at Valencia.

Read.—A memorandum from Captain Toynbee reporting that since the last meeting five logs had been received, two of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Captain G. Campbell	"Janet Cowan"	May 13, 1879—Feb. 11, 1880.	Bombay, Bassein, and home.	——
Captain W. R. Cato	S.S. "Scotia" -	Nov. 10, 1879—Feb. 15, 1880.	Laying cable from Aden to Zanzibar.	1877, p. 17.

Mr. Scott was instructed to present the Charts (O. 32) to Captain Campbell, and to convey the best thanks of the Council to Captain Cato.

Read—A letter from Messrs. De La Rue & Co. (No. 624), stating their willingness to erect a sunshine recorder, if requested by the Council (Minutes, February 21).

It was resolved that the subject of tabulation of the records of these instruments be considered at next meeting.

Read—Letter 583 from Sir James Ramsden, proposing to maintain at his own expense a telegraphic reporting station at Barrow-in-Furness.

The Secretary was instructed to inform Sir James Ramsden that the Council offer their sincere thanks to him for his very public-spirited proposal, and most gladly accept it.

Submitted—The complete Summary of Rainfall and Temperature for publication with the Weekly Weather Report (Minutes, p. 121).—Approved.

Submitted—The following report:—

February 29th, 1880.

STATEMENT of WORK done in PANTAGRAPH ROOM during February 1880.

Copper plates have been engraved as follows:—1879, Plates 53 to 58, omitting wind and rain curves; Plates 45 to 48, wind and rain curves added.

Zinc plates:—Barograms, 8 plates, Nos. 53 to 60, 1879; Thermograms, 3 plates, Nos. 62 to 64, 1879; Vapour tension, 6 plates, Nos. 53 to 58, 1879; Anemograms, 3 plates, Nos. 47 to 49, 1879; Rain curves, 3 plates, Nos. 47 to 49, 1879.

Photographic curves have been prepared for pantagraphing up to Plate 63 for barograms, and Plate 70 for thermograms.

A good deal of time has been expended upon experiments with the Harmonic Analyser during the month.

The November tabulations received from Mr. Allen on the 3rd were examined and passed to the Computing Room on the 10th; the December sheets have not yet come into my hands.

Mr. Allen's memorandum is attached.

R. H. Scott, Esq., F.R.S. R. H. CURTIS.

February 23rd, 1880.

STATEMENT of WORK done in the EXAMINATION ROOM since January 23rd, 1880.

The following curves and tabulations have been examined:—November: *Barograms*, four stations; *Anemograms*, three stations.

December: *Thermograms*, all stations; *Barograms*, five stations; *Anemograms*, four stations.

To R. H. Scott, Esq. T. E. ALLEN.

March 1880.

STATEMENT of WORK done in MARINE ROOM during February 1880.

New logs examined, 18 in No.

Cape of Good Hope District.

Winds.—Generalized wind arrows entered for January.

Barometer.—Frequency of observations obtained for each tenth of an inch, and diagrams of same drawn for January, diagrams also re-drawn on January wind and air temperature chart.

Air Temperature.—Isotherms of air for January combined with wind chart.

Means and range for single-degree squares obtained and charted for February and March, and partially for May. Isotherms drawn for October.

Currents.—Individual currents charted for September, November, and December.

Generalized current lines entered afresh for July.

Sea-surface Temperature.—Means and range for single-degree squares obtained and plotted for February, also obtained for March, and partially for May, June, August, September, November, and December.

Cape Gales.—Various work done in connexion with the July data; also examining the Cape of Good Hope Observatory observations, supplied for use in connexion with the January data.

Estimate formed of cost of a copy of Marine Meteorological observations for part of Indian Ocean.

Index of data in Ocean ten-degree squares posted to date.

CHARLES HARDING.

R. H. Scott, Esq.

HENRY TOYNBEE,
Marine Superintendent.

Mr. Scott reported that he had been offered, for the price of 12*l.*, an automatic aneroid, by Messrs. Hottinger of Zurich. The instrument had been tested at Kew, and was found to work satisfactorily.—He was authorised to purchase it.

The following cheques for February were drawn on the 28th of that month:—

		£ s. d.	£ s. d.
Administration:			
R. H. Scott, salary		- - -	66 13 4
J. S. Harding, jun.	Salaries and wages	27 15 6	
T. D. Bell		13 6 8	
J. S. Harding, sen.		*8 19 8	
			50 1 10
Special Researches:			
E. Schneider, "Schwackhofer's" hygrometer		- -	25 18 0
Land Meteorology:			
Bates, Gildea, & Walker, photographic trays		7 3 8	
" " " "		1 9 9	
			8 13 5
J. E. Cullum, salary		- -	15 16 8
R. H. Curtis	Discussion, &c. of Observations.	22 4 5	
J. A. Curtis		15 11 1	
T. E. Allen		15 11 1	
C. H. Thompson		*9 4 0	
E. G. Aldridge		*7 6 8	
			69 17 3
Weather Information and Forecasts:			
H. Ellison, repairing screen, &c. (Shields)		- -	0 13 0
H. Mohn, allowance to observers		- -	1 16 8
Postmaster General; Office wire		22 0 0	
" " telegrams, December		210 11 2	
			232 11 2
Hopkinson & Cope, covering rollers for printing press		- -	0 10 6
F. Gaster	Preparation and issue of Reports, &c.	31 13 6	
W. L. Dallas		19 15 1	
F. Brodie		19 2 0	
H. W. Chivers		*6 12 0	
			77 2 7
For Ocean Meteorology:			
Captain H. Toynbee		33 6 8	
R. Strachan	Discussion, &c. of observations, and care of instruments.	27 15 6	
C. Harding		22 4 5.	
H. Harries		*11 4 0	
Lieut. C. W. Baillie		16 13 4	
			111 3 11
J. J. Hicks, thermometer screens		- -	25 8 4
Miscellaneous:			
Pickford & Co., conveyance of parcels		- -	1 5 7
J. S. Harding, jun., petty cash		100 0 0	
" "		80 0 0	
			180 0 0
	Total	- -	£867 12 3

* Four weeks to the 28th February.

The Council then adjourned.

116, *Victoria Street*, *March* 20, 1880.

PRESENT:

PROFESSOR H. J. S. SMITH IN THE CHAIR.

MR. DE LA RUE.	PROFESSOR STOKES.
MR. GALTON.	GENERAL STRACHEY.

THE HYDROGRAPHER.

The Secretary was in attendance.

The Minutes of last meeting (March 6) were read and confirmed.

Read—The following letter (Minutes, p. 131):—

No. 3944.
M.O. 697.

SIR, Treasury Chambers, March 11, 1880.

WITH reference to your letter of the 17th ultimo, relating to the publication in newspapers of weather information and forecasts, I am directed by the Lords Commissioners of Her Majesty's Treasury to request that you will inform the Meteorological Council that my Lords have instructed their Solicitor to meet yourself and the Chairman of your Council, in order that he may clearly understand what are the points which your Council requires legal advice.

I am therefore to request that you will let the Solicitor of the Treasury (A. K. Stephenson, Esq.) know on what day and hour between 12 and 2 o'clock it will suit the Chairman of your Council and yourself to call at the Treasury for this purpose.

I have, &c.

The Secretary of the Meteorological Council. (Signed) R. R. W. LINGEN.

The Chairman reported that in accordance with the above letter the Secretary and himself had had an interview with the Solicitor to the Treasury on the 18th instant, and he submitted a memorandum (Letter 774) of the remarks made by the Solicitor to the Treasury in reply to questions put to him.

The Secretary reported that in pursuance of instructions given at last meeting (Minutes, p. 144), he had forwarded the subjoined letter to General Myer:—

P.C. 724.

SIR, Meteorological Office, March 11, 1880.

YOUR telegrams of the 25th, 28th, and 29th of February last, addressed to the Hydrographer of the Admiralty, were laid before the Meteorological Council at their meeting on the 6th instant, and, by their direction, I on that day telegraphed the reply, "Dissent for present. Letter follows."

I am now instructed to explain that the Council (while fully recognising the importance of your initiation in the matter) are not prepared to accept the proposed change of hour until they are informed that other nations are willing to concur in it.

With a view of ascertaining whether such concurrence could immediately be obtained, communications were sent on the 1st instant from this Office to M. Mascart at Paris, and to Professor Wild at St. Petersburg. The tenour of the replies received, copies of which I now enclose, was such as to satisfy the Council that they would be acting precipitately if they were to give their adhesion to a change of hour, without further consideration.

As the Hydrographer of the Admiralty has already informed you by telegram, the issue, to the ships of Her Majesty's Navy, of instructions and forms for synchronous observations has been suspended, and since, when these instructions and forms are once issued, it would be undesirable to change them until after some considerable time (say a year), it has been thought advisable to continue the suspension until a fuller communication is received from you than is possible by telegram.

I have, &c.

Brigr. General A. J. Myer, U.S.A., Chief Signal Officer, Washington. (Signed) ROBERT H. SCOTT, Secretary.

The subject of the tabulation of sunshine records (Minutes, p. 148) was discussed, and it was resolved—

That forms, ruled in hours and half hours, on which the records are to be copied graphically, be sent to each observer. The forms to be arranged in weeks, ending on Monday evening; a column to be added for a numerical estimate of the whole duration of sunshine on each day.

The form and the instructions to accompany it to be settled by Professor Stokes.

It was further resolved that the results be printed in the Weekly Weather Report from April 1, the number of hours of sunshine being given for each week, and also the percentage proportion of sunshine to daylight.

The Secretary was authorised to modify the arrangement of the Weekly Weather Report, so as to show the seven charts at one opening, viz., on pp. 2 and 3, instead of on pp. 3 and 4. The change to take effect at the beginning of April.

Read—A memorandum (Letter 784) from Captain Toynbee, relating to the discussion of the Cape of Good Hope gales for July, with the manuscript of the discussion (Minutes, 1879, p. 50).

The Secretary was instructed to have the manuscript set up in type.

Read—A memorandum from Captain Toynbee, reporting that since the last meeting seven logs had been received, six of them being "excellent."

Observer.	Ship.	Period.	Voyage.	Last mention on Minutes.
Capt. R. Chitham	S.S. "Torrington"	Oct. 26, 1879—Feb. 21, 1880.	Southampton, Pedang, Batavia, and home.	1879, p. 74.
Capt. J. Maclear - Lieut. C. W. de la Poer Beresford.	H.M.S. "Alert"	Oct. 3, 1879—Jan. 31, 1880.	Surveying Straits of Magellan.	1879, p. 137.
Capt. Peter Murdoch	Ship "Sierra Madrona."	Apl. 9, 1879—Mar. 3, 1880.	Liverpool, Bombay, Chittagong.	—
Capt. R. H. Napier	H.M.S. "Magpie"	May 1—Aug. 31, 1879.	Surveying in China Seas	1879, p. 98.
Do. do.	Do. do.	Sept. 1—Dec. 31, 1879.	Do. do.	
Capt. W. H. Smith, R.N.R.	S.S. "Peruvian"	April 21—Dec. 26, 1879.	Liverpool to Quebec (five voyages).	1879, p. 9.

Mr. Scott was instructed to present the charts to Captain Murdoch and Mr. Beresford, and to convey the best thanks of the Council to the other observers.

Submitted—A draft specimen, prepared by Mr. Gaster, of the Quarterly Weather Report for January 1876 (Minutes, 1879, p. 118). The draft was discussed in detail, and was referred back to Mr. Gaster for modification, General Strachey undertaking to offer some suggestions as to the form of the earlier portions of the text.

Captain Templer, of the Royal Middlesex Rifles, at present conducting the Balloon experiments at Woolwich, attended the meeting, and expressed his readiness to make the ascents useful to Meteorological science in any way he could.

It was agreed to prepare a memorandum for him, suggesting the principal points of importance for Meteorology to which attention should be specially given in the series of balloon ascents now about to be undertaken.

Read—Letter 655, from the Royal Agricultural Society, containing an extract from the Minutes of the Council of the 3rd instant, expressing favourable opinions of the value of the Hay Harvest Forecasts in 1879.

The Secretary laid before the Council a copy of the following circular, which had been addressed by him in his capacity of Secretary of the International Meteorological Committee (Minutes, p. 1), and in pursuance of instructions from Professor Wild, the President of that Committee, to the chief Meteorological Institutions of Europe:—

CONFERENCE for AGRICULTURAL and FOREST METEOROLOGY.

Meteorological Office, 116, Victoria Street, London,
March 6, 1880.

SIR,

IN pursuance of a Resolution passed at the Second International Meteorological Congress at Rome, in 1879, I beg to inform you that the International Meteorological Committee have decided upon convening a special International Conference to take into consideration the development of Agricultural and Forest Meteorology.

I have received an invitation from Ministerial-rath Dr. J. R. Ritter Lorenz von Liburnau, for the Conference to be held at the Academy of Sciences in Vienna, and it is proposed that the first General Meeting should be at 11 a.m. on the 18th May next. The Conference will probably last five days.

I have the honour to invite you to attend the Conference personally, or, to induce some competent person or persons to represent your organization. I shall be obliged if you will inform me *as soon as practicable* of the names of gentlemen who will attend, in order that I may communicate to them any further particulars which may be necessary.

It is requested that the members will attend Preliminary Meetings on the 17th May, from 10 a.m. to noon, and from 5 to 7 p.m., to make arrangements for the General Meeting next day.

I have, &c.

(Signed) ROBERT H. SCOTT,
Secretary to the International Meteorological Committee.

Reported—That the cash accounts for the six months ended 30th September 1879 were audited by the Chairman and General Strachey on the 10th instant, and had been sent to the Treasury for the Audit Office. The receipts for the six months, exclusive of a balance of 1,727*l.* 5*s.* 1*d.* on the 1st April, amounted to 7,974*l.* 15*s.* 7*d.* The payments amounted to 8,037*l.* 10*s.* 9*d.*, leaving a balance of 1,664*l.* 9*s.* 11*d.* in hand and at the Bank, on the 1st October 1879.

The Council then adjourned until Saturday, April 3, at 11 a.m.

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[2521.—25.—4/80.]